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ABSTRACT

Research findings on college instruction and technology and the future are discussed in 15 papers from the first Regional Conference on University Teaching at New Mexico State University. Titles and authors are as follows: "Technology, Teaching, and the Future" (William F. May); "Bauhaus Experience: A Team Method of Teaching Technology" (Euguene W. Balzer); "Advance Organizer: An Effective Pre-Instructional Strategy" (Moon K. Chang); "Teaching, Technology, and the Meditative Pause" (Jim W. Corder); "The Concept of the Rio Grande Institute" (George A. Cowan); "Reaching for the Potential" (Paul R. Dingman); "Integrating Information Technologies into Learning: Decision Criteria for Faculty and Administrators" (David R. Holmes); "Hands-On Program of IBM-PC Training at Los Alamos National Laboratory" (Ruth Lier); "Educating the Information Society, Revised" (Gary M. Moulton); "Artificial Intelligence and the University Covenant: Speculations about the Impact of Technology on the Purposes of Education" (Eugene Potter); "Teaching, Technology, and the Future" (Eugene Ross); "'Magatrends' in Higher Education" (James W. Schreier); "A Bright Future for Instructional Television through Technology" (Darrel Schroder, Anthony Tarquin, Lionel Craver); "Can Computer Attitudes Inhibit Teaching to Potential" (Sara Dawn Smith); and "Instructional Television Fixed Service: The Challenge to Educational Institutions (Kim B. Walker). (SW)

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TECHNOLOGY, TEACHING, AND THE FUTURE

by

William F. May

Georgetown University

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TECHNOLOGY, TEACHING, AND THE FUTURE
William F. May
March 1985

This essay on technology, teaching, and the future will cover both less and more than the announced title: less, because it will not discuss one-third of the advertised subject, that is, the future.

That omission will disappoint some. Our thirst for knowledge about the future knows few limits. Conferences abound on the subjects of "Business and the 80's," "Medical Ethics Ten Years Ahead," "The U.S.A. in the 21st Century." Our anxiety about the future is understandable enough. It goes back to the Greek general and his need to consult the entrails of birds on the eve of battle. Leadership means going--going ahead into the uncertain X of tomorrow. And that X stirs anxiety in decision-makers. Hence, the need for propnets and oracles, the modern equivalent for which is the consultant. In our day, consulting is a growth industry. Within the academy, social scientists have largely trained those experts who traffic in predictions. As opposed to humanists who deal with cultures in their singularity and who orient to great texts of the past, social scientists deal cross-culturally with human behavior in its generality and orient to the future.

But social scientists have recently turned more cautious about their capacity to discern the future. They used to talk about prediction, but they have down-shifted from predictions to projections, and more recently from projections to scenarios, and to multiple scenarios at that.

I tend to be cautiously agnostic about the future. As hard as we try to peer into the future (or buy books that cry shrilly of future shock) the future truly shocks because it is not transparent. For at least two reasons, the future confronts us as opaque.

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First, the radical novelty of discovery and invention. While we can follow the track of discoveries and inventions already here or guess at the vector of others subject to incremental changes, or anticipate the widespread applications of still others, we cannot anticipate radical novelty, radical invention, because if we did, in a sense it would already be discovered, invented, already here.

Second, we can, in a sense, anticipate the impacts of technology on human beings, but, unless we are already convinced technological determinists and assume that human beings are wholly the victims of what they have wrought, we cannot predict what human beings will do with a given invention and application as it spreads throughout a culture. Thus freedom, as well as radical discovery, renders the future opaque.

That leaves me, then, with two-thirds of the title: technology and teaching. But I hope to broaden that title. I warned those who invited me to New Mexico State University that I was not competent to appear as an expert either on the computer or data base retrieval systems. They assured me that the university has its own in-house experts on that. Rather they wanted me to step back a bit and provide a philosophical overview on the general place of technology in the setting of an institution of higher learning, especially in its teaching enterprise. I accepted this assignment in the hopes of providing a general framework for which the real experts in subsequent sessions can provide more detail.

The business of a university is knowledge; technology links with knowledge at three points: its acquisition; its transmission; and its application. These three modalities of knowledge remind us of the threefold criteria by which universities judge their faculty members for tenure and promotion: research refers to the acquisition of knowledge;

teaching, to its transmission; and service, to its application. In assessing, however, live faculty members--those strange folk who talk and write for a living, fall in love, and worry about salary increases and retirement benefits--the emphasis falls on the first two criteria, research and teaching. In the assessment of technology, almost all the emphasis falls on service.

1. Technology and the application of knowledge. The emphasis on the value of knowledge as "service" shows up in almost all work on the subject of technology. Consider, for example, Daniel Bell's essay on "Technology, Nature and Society." He defines technology as "The effort to transform nature for utilitarian purposes."[1] He roots this power and effort in homo faber, man the maker, and cites the classical myth of Prometheus, who stole the fire of reason and creativity from the gods. But the Greeks chiefly celebrated the human capacity for reason not the capacities acquired through reason that might serve human purposes. The West had to wait for Giordano Bruno and Francis Bacon of the late sixteenth and early seventeenth centuries for its hymns of praise to a knowledge linked with dominion and power. Bruno wrote:

> The gods have given man intelligence and hands, and have made him in their image, endowing him with a capacity superior to other animals. This capacity consists not only in the power to work in accordance with nature and the usual course of things...but beyond that...to the end that by fashioning, or have the power to fashion, other natures, other courses, other orders by means of his intelligence, with that freedom without which his resemblance to the deity would not exist, he might in the end make himself god of the earth.[2]

Bacon, from this point forward (1583-5), felt that "a new order of events was at hand, the specific quality of which would consist no longer in a mere imitation of nature but in her domination by man."[3] Inasmuch as knowledge is power, the virtue of curiosity leads to virtuosity--the capacity to work great changes in nature--to produce magnalia naturae to match magnalia dei.

This godlike power, moreover, that flows from knowledge should redound to the benefit of humankind. Francis Bacon linked knowledge and power with universal benefit. This philanthropic outcome distinguishes scientists from mere magicians and alchemists. Wizards and magicians link knowledge with power, but they are tempted to think in proprietary terms about that powerful knowledge which they display. Bacon complained that they transform nature, but simply in order to arouse wonder and not to serve some larger human purpose. They are vain-glorious and self-seeking. They believe themselves to belong to a privileged class of illuminati, hermetically sealed off from the human race at large. The scientist, Bacon insisted, must add the virtue of philanthropy to those of curiosity and virtuosity. As Benjamin Farrington has observed, the new knowledge to be gained should be "...fed back into the industrial life of the nation. This was no small task, as Bacon well knew. It was King's business. It should not be left to the monk in the cloister, the alchemist's furnace, the rich nobleman's curiosity or the workshop of the artisan. It required to be taken under the wing of the government. For it was not simply an addition to knowledge but the inauguration of a new way of life, the great instauration of man's dominion over the universe."[4]

Bacon, take note, spoke of man's dominion over the universe, not of the dominion of some men over the universe, or of some men over other men, or of one generation over future generations. This universalist impulse distinguishes the scientist from the parochial magician, the wayside wizard, and the hermetical alchemist. The enlargement of powers reflected not the limited triumph of some, but the enhancement of the many. To this very day, we hold on to this sense of participation in knowledge and power. "One small step for man, a giant step for mankind." When we hear talk about the enlargement of human powers through science we are inclined to neglect the questions of whose power over what, at what price, and over whom, the question that especially haunts some today in the grand schemes for genetic engineering. We are inclined to gloss over these pointed questions and assume that the power acquired through knowledge eventually runs off into a kind of reservoir of power at the general disposition of the human race.

2. Technology and the acquisition of knowledge. Technology serves also the research enterprise. Here the emphasis falls not on utility and service but on knowledge as an end in itself. The myth of the holy grail, the quest for the intrinsic good replaces Bacon's Boy Scout myth of the great philanthropist.

I do not need to rehearse in this setting the role that technology has played in the acquisition of knowledge. The chairperson for every department in the sciences knows just how important technical equipment is to the research enterprise. It casts the most towering shadow across the budget. It affects the ability of the department to recruit its faculty members. Yet it is the sine qua non of a cathedral, research institution and almost every ambitious university campus has aspired to become such.

Nowhere has the importance of technology loomed larger in research than in the life sciences and there it has created problems for the notion of knowledge as an unconditional and intrinsic good. First, and most dramatically, the recombinant DNA debate posed questions about knowledge as an absolute good. Although that debate has largely resolved in favor of the advocates of such research--the dangers proved to be much less than first feared--the debate lifted a rock that exposed much to light.

When advocates for the research sold the enterprise to the community at large, they relied on the Baconian links between knowledge, power, and boon. They held out the prospects that the research would lead to a knowledge and perhaps control and cure of a variety of cancers and inherited diseases, such as diabetes and hemophilia, to the production of inexpensive new vaccines and plants that draw their nitrogen directly from the air rather than from costly fertilizers, and to a vastly improved knowledge of the genetics of all plants and animals and, eventually, humankind.

Other advocates of the research, however, appealed not to wondrous applications but rather to an unconditional right to know. The latter appeal raised the most interesting questions. It invoked the deepest of commitments to academic freedom. Critics of this second appeal noted that advocates of the research were, in fact, extending the doctrine of the right to know beyond its traditional limits. They were claiming not simply the right to know but the right to create unprecedented forms of life in order to attain that knowledge. Technology, in this case, is not simply an incidental by-product of the research but its indispensable pre-condition.

The special links between technology and the acquisition of knowledge in recombinant DNA research led to worries in the scientific community and in the public at large and to the development of federal guidelines. Some scientists, in turn, worried that such guidelines would constitute the wedge that would undercut the hitherto unconditional quest for knowledge. Today the geneticists, tomorrow, the linguists! The argument, however, based on the thin edge of the wedge, cuts only so deep. Federal regulations in this case would not justify a limitless intrusion on the right to know but regulate that right only as it requires the production of new forms, the deleterious consequences of which may possibly be great but cannot be fully assessed in advance.

As it turns out, those consequences have not been as serious as first feared. But some measure of caution made sense, at the outset, and scientists showed restraint at the Asilomar Conference. The fact of uncertainty attendant to the original research invited some wariness. It argued not for the green light of the technological triumphalists or the permanent red light of the alarmists but for an amber light. This caution itself may have some exemplary force as the society proceeds to the subsequent assessment of industrial applications. We cannot bemoan wanton and runaway applications if we have not laid carefully our moral foundations in the very acquisition of knowledge.

3. Technology and the transmission of knowledge. Broadly conceived, teaching includes not only the instruction of students but the teaching of colleagues. Writing for publication is part of the transmission of knowledge. Faculty members engage in teaching when they write articles, monographs, book reviews, and books. It is teaching without a classroom,

teaching to a wider audience of peers, who may or may not yet be engaged in a similar research enterprise. Thus, this essay on technology and teaching will have to consider the dual settings of students and colleagues.

The subject of technology, as it affects the transmission of knowledge, divides into two parts: the impacts of technology on the process of teaching and on the content of teaching. Impacts on the process of teaching further divide into impacts on the sciences and the humanities. I will emphasize the effects on the humanities because I am more competent to discuss the humanities and partly because impacts there may, in the long run, be more striking.

a. The Process of Teaching in the Sciences. The impact of recent technology on instruction and testing in the sciences is large, but, in two ways, conservative. First, it continues to strengthen the ancient apprenticeship system. Long before the advent of the computer, the enormous importance of equipment in scientific research and the need to cultivate in students research techniques had a conservative impact on instruction. The young learned by initiation into the research enterprise under the tutelage of senior scientists. They assimulated the activities of the research team. This apprenticeship system is a very old teaching tradition indeed, which the computer and other technological advances would not appear significantly to alter.

Second, instructors in the sciences will probably assimilate and utilize computer technology without disturbing the traditional characteristics of scientific instruction as sequential, incremental, and oriented to problem-solving. Further, the computer facilitates traditional modes of testing in the sciences. It handles superbly the

grading of multiple choice and other types of examinations that allow for straightforward verification and falsification. In these aspects, the computer fits in with the sciences less disruptively than with traditional modes of instruction and testing in the humanities. With the exception of language study, knowledge and therefore course instruction in the humanities are only waywardly sequential. Further, the humanistic disciplines orient to problems which are hardy perennials rather than solubles, and they produce results more aptly displayed in interpretive essays, rather than in isolable true and false statements. On the face of it, the impact of the computer on scientific instruction and testing would disrupt traditional patterns less dramatically than in the humanities.

Although the computer would not seem to alter significantly patterns of student instruction in the sciences, it will change dramatically the mutual instruction that goes on amongst peers in scientific research. The computer permits scientists to contact one another and teach one another through "networking." This rapid computer access to the work of colleagues alters the meaning of publishing, the role of the library, and perhaps even the role of the local campus in peer instruction.

Traditionally, scientists went public through publishing; thereby teaching others and exposing their work to peer criticism. But the speed with which exchanges can occur through computer networking may, at least in some settings and for some fields today, convert the formal act of publishing into a ritual of little more than archival/historical significance. The tedious lead-time required to place articles in

journals today forces publications to lag even further behind the numerous exchanges and transmissions that occur through networking. The book becomes, at best, the tortoise in the transmission of scientific knowledge.

-Librarians have recognized these changes in the making and have begun to think of themselves as information centers rather than vaults for books. In some fields the data bank is crucial.

-Computer networking may also reduce the significance of the scholarly meeting as the forum in which scientists share their work in advance of publication. It provides cheaper and quicker access to colleagues than the jet plane.

-The computer also allows a research team--dependent as it is on mutual teaching among its members--to span institutions. Technology may reduce the significance of the campus as the local parish, as it were, in academic life, the place where exchanges of knowledge normally take place. Will it thereby lessen in turn the importance of a few cathedral institutions as the hosts for research? Will gifted faculty members at less prestigious institutions participate more easily in research projects? Will the phenomenon of networking help to democratize opportunities for faculty members, make them a little less dependent upon local investments in a big research library and all manner of lab equipment? These questions loom large, especially for younger faculty members who have entered the job market at a time of great over-supply and who have not secured posts at institutions commensurate with their abilities.

I have put these questions to consultants at the Carnegie Foundation working on these isssues, and they said, in effect, don't count on it.

Networking may in fact intensify exclusivity. It may produce some sharp distinctions between those who are "in the know," and those with only delayed access to information through more conventional outlets.

We may, therefore, need to face again the question of what it means to "go public" with research. Traditionally, the academician differed from the detective, the lawyer, the doctor, the FBI agent and the corporation research team, in that his research did not belong to a client--whether an individual, an institution, or the nation. Publicness is the essence of academic knowledge. It should enter into the commonwealth of learning. Knowledge exists to be taught, transmitted, and shared. Nationalism, in recent decades, has challenged this universalist impulse of the Academy. "For your eyes only" has replaced the earlier ideal of "for the eyes of anyone with the skill to read and to discern." Technology, in subtler ways than nationalism, may impose further limitations on the sharing of knowledge. Networking amongst a highly select circle of collaborators narrows the community with access to the latest research. We may need further reflection on the publicness of knowledge and the obligation of professionals to give access to that knowledge in diverse fora.

At the other extreme, the computer poses a challenge to the confidentiality of knowledge, especially knowledge whose original justification was its benefit to clients. Information about patients finds its way back into data banks which, in turn, provide access to users (such as insurance companies, employers, the government) who might exploit that knowledge for their own purposes adverse to the interests of the client. Thus the computer poses new questions for an old issue: the relative balance between the values of publicity, privacy, and secrecy in a democratic society.

b. Technology, the teaching process, and the humanities. The computer, of course, comes last in a long series of technologies that have affected the teaching process in the humanities. The written word, the printing press, and the television set precede it. Traditional societies depended upon the human capacity to remember what one heard. Oral traditions were inherently public (they required both a speaker and a hearer) and potentially disputatious (they allowed for give-and-take in the course of the transmission of knowledge). The written word, by contrast, emphasizes privacy (one usually reads alone) and encourages an assertive rather than a disputatious style (inasmuch as it is not open to direct contest). The invention of letters obviously extended human powers in that it enabled messages to span the obstacles of space and time. But, as Marshall McLuhan and Fr. Walter Ong, S.J., have emphasized, it also altered, and, in some ways, reduced human capacities. Plato observed in the Phaedrus that the Egyptian God, Toth, the inventor of letters, created forgetfulness by encouraging people to rely exclusively on the external written characters.

The printing press dramatically increased and extended the power of the written word. The increase in the number of scholarly journals alone illustrates the magnitude of this technological advance--from ten journals in 1750 to 100 in 1800, to perhaps a thousand in 1850, to an estimated 30,000 to 100,000 today.[5] This so-called knowledge explosion, of course, does not produce a pure gain. Since no one, not even the expert, can master all this available knowledge, the knowledge explosion has also generated an ignorance explosion. Since, moreover, knowledge creates power, ignorance correspondingly creates a sense of powerlessness. Even the expert is ignorant, and therefore powerless in

much that affects his life. This state of affairs may help to explain the highly ambivalent feelings we harbor toward the knowledge-wielders in our culture--the doctors, the lawyers, the market experts, and the like. At once we need their expertise and yet we suspect them as they exercise power in the midst of our ignorance. Thus, changes in the process by which we acquire knowledge eventually produces a huge gap between the knowledge possessors and the society at large. A whole new class of professionals arise who become the dispensers of services from which patients, clients and the like benefit, but which at the same time renders them somewhat helpless and powerless.

The technology of television did not directly alter education as much as most people expected, at least not in the sense that television became a major aid and tool (or surrogate) for classroom teaching. But, in other ways, television has dramatically affected the teaching process. Children and young people spend more time before their television sets than in the classroom. For better or for worse, TV and allied media have largely supplanted the earlier teaching authorities of Western culture: first, the magisterium of the church; second, the apprenticeship system; and, more recently, the public school system. The ascendency of the new medium has affected the teaching function in at least three ways.

It has undermined the habit of patience which the medium of the written word requires--patience in acquiring skill in reading, patience in tracking after a line of thought that develops across the sentences and paragraphs of an essay, patience in acquiring the education that will yield as its reward a unilinear career, and patience, at length, in developing a career that requires hard work at the outset for the sake of a payoff at 45 or 50 years of age. Another name for this patience is

deferred gratification. Not surprisingly, commentators dubbed the protest generation of the late 60s--nursed by the TV set--the Now generation. Students in the new culture period oriented with a vengeance to the present. They expected their information to come in twenty-second bites. Forty seconds seems an eternity on TV. One can, of course, convey some information within those constraints, and the artful TV host can signal an attitude with a glance--the mocking tone, the lifted eyebrow, or the glittering cynicism of a Johnny Carson. But a complex appraisal, or an intricate argument, looks hopelessly out of place within the constraints of TV. Thus, one tends to settle for information rather than knowledge, wisecracks rather than wisdom, a stance toward a subject rather than its painstaking interpretation.

Perhaps the tendency of TV to encourage a cynical attitude may be its most dangerous impact on education. Everyone feels some objective warrant for cynicism in the course of his or her education. It properly undercuts the tendency to glamourize, sentimentalize, or idolize the merely ordinary. But cynicism, when it fixes itself in the young, dangerously obstructs education. It destroys the capacity for discriminate appraisal. Everything gets trashed. The noble as well as the trivial reduces to the same rubble in the cynic's eye. At its worst, cynicism is an uneducable style. The habits of impatience and cynicism which TV reinforces daily do not easily convert into the discipline required in the classroom.

Further, TV affects the very telos, or aim and purpose, of teaching. In orienting the viewer to the present moment it emphasizes chiefly gratification. Students, by habit, justify schooling for its usefulness in enlarging opportunities for consumption, by providing them with a

career and enlarging their capacity to savour those goods which a career places within reach. The medium reminds the watcher daily that, above all else, he is a consumer.

By delivering this Jeremiad I do not want to present myself as a Luddite, ready to smash any and all TV sets. In the moral life, Aristotle once noted that we should not expect to eliminate what we are but learn how to lean against our weaknesses. Similarly, we need not eliminate any and all of our prevailing technologies, but learn how to lean against their weaknesses.

While scholars in the humanities may not use the computer as much in teaching as their colleagues in the sciences, its use will surely increase, especially in highly sequential language instruction, and certainly surpass the use of TV as a teaching aid. We may expect several impacts similar to those already sketched in the discussion of the sciences. The library will broaden into an information center whose resources for sharing knowledge far transcend that of printed books and articles. The organization of information and retrieval systems allows for interactive team research that extends beyond the local campus (although humanists work less often in teams than their colleagues in the social and natural sciences). Computer-aided instruction will give the scholar and student in remote areas access to instructional resources thus overcoming some of the limitations of the bounded residential campus.

One wonders whether computer technology will diminish the role and authority of the individual teacher. Will computer technology put teachers out of business the way fluoride, dental sealants, and anti-bacterial agents have reduced the need for dentists? Martin Buber once defined the teacher as the one who experiences what the student is

going through, whereas the student does not experience what the teacher is enduring. Computers seem to comply with this definition. They anticipate our questions and mistakes, they substitute algorithms for human judgment.

Each major technological development in communications appeared to threaten the place of the teacher. Oral cultures absolutely required teachers; learners needed to hear words directly vocalized by their mentors to have access to knowledge. The written word, however, allowed one to do without the living presence of the teacher by giving access to the absent instructor, the one whose voice one had never heard. Students could work with texts in solitude. The later invention of the printing press greatly extended the reach of knowledge without the mediation of living teachers. The computer goes still further. At least the printed word gives the reader the sense that she deals with an author--a human presence to be reckoned with. Even though absent or long since dead--the author exists as a teacher. The working computer with its silicon chips simultaneously resembles the human brain as no text on the printed page does; and yet, it never gives one the sense that one reckons with an author. The original programmer remains somewhat elusive--despite the little jokes and asides and contrived intimacies inserted into the program. The advances in technology from oral to digital transmission would appear to dispense increasingly with the teacher in the acquisition of knowledge.

Yet, the teaching profession did not disappear in the course of earlier technological innovations, and we have little reason to think that the computer will eclipse the teacher today. The printed page, to be sure, dispenses with the oral transmitter of sacred stories, but it

generated a need for mediators and interpreters of established texts. The classroom also served as the generator of new texts. Teaching, if anything, became more creative. In an oral culture, teachers had to repeat what they had received. Repetition guaranteed the persistence of a tradition. The printed word allowed teachers to dispense with repetition. It left them free for the hermeneutical task of interpreting, evaluating, and applying texts to new settings and conditions. Thus the meaning of tradition itself changed. Tradition no longer entailed the umbilical receiving of stories from one's elders. One distanced oneself from a text as one received it through the acts of interpretation and re-interpretation. This more distanced form of traditioning provoked a new mode of oral discourse, not pupils reciting what they memorized, but learning to discuss a text. It thus cleared the way for the production of new texts; that is, the refurbishing of old traditions and the introduction of new ones.

In one sense, the impact of computer technology on instruction and testing in the humanities will remain limited. Except for introductory language instruction, the humanities disciplines do not easily lend themselves to sequential, unilinear, and incremental instruction. Further, true and false tests and multiple-choice examinations systematically falsify the meaning of the mastery of a subject in the humanities. Such mastery depends upon the organization of materials into intelligible wholes expressed in writing and speaking. But a very specific feature of computer technology--word processing software--should dramatically and favorably facilitate the development of that mastery.

Properly used, word-processing software will renew the importance of writing/editing in the humanities, the role of the teacher in that process, and perhaps help the student recover a sense of both the social and substantive purposes of writing.

Until recently, the sheer laboriousness of retyping papers reinforced other tendencies in American education that have discouraged students from editing and rewriting their examination papers. Teachers have merely served as judges of the final projects, giving them grades and offering a few marginal comments to justify in lawyerly fashion a given grade. Meanwhile, whatever students learned about English grammar tended to intimidate them as writers. They assumed that the rules of grammar served as rules of writing, telling them what not to do. Students must keep these stern rules in mind as they attempt to strike off error-free sentences; and since in their hearts they know that they cannot produce faultless prose, instruction in grammar tended to paralyze them as writers. Few sentences could run the gauntlet of the rules unscathed. Students thus solved their problem of writing by procrastinating until the last minute, then writing rapidly and desperately and turning in the unedited results. The ensuing grade merely confirmed what they already knew--their papers were not worth much (unless the teacher, desperate for students at a time of declining enrollments in the humanities, yielded abjectly to grade inflation and awarded cynically high grades for getting anything in at all.)

The computer will not, in and of itself, change all this, but word-processing software creates at least the objective possibility of reform. It eliminates the purely laborious side of rewriting, and therefore lets the teacher function as master editor, and encourages the

student himself to learn something about editing as he rewrites his paper, both before and after turning it in. This reform, of course, will not occur unless a student learns that the rules of grammar serve primarily not as a means of writing well, but of editing well. The art of writing is rewriting, that is, editing one's prose. Such books as the Elements of Style serve not as a manual for striking off perfect sentences but rather as a help in identifying lame sentences and learning how to fix them.

This "fixing up" of one's prose, however, will trivialize if it seems no more than a way in which one learns how to dress up what one already knows. At its best, the discipline of writing an essay is a heuristic enterprise in which one does not merely package and disseminate what one already knows, but partly discovers it through the eyes of a stranger. As the saying goes, one learns through teaching. To the degree that the computer assists the student in becoming a better teacher through his writing, it strengthens the student as a student.

We will not, however, fully exploit these potentialities of the computer unless teachers accept it as part of their responsibility to develop students into good teachers whether they go into the teaching profession or not. Today, professors bemoan the fact that few of their students will enter the field of teaching. They flock for economic reasons to the non-academic professions. But that does not mean that they need not be good teachers of what they know in their writing and speaking. To do a good job in preventive medicine today a physician must be an effective teacher of her patient; to do a good job of counseling the client, the lawyer must effectively teach her client; to be effective in politics, a leader must effectively persuade his fellow citizens;

admittedly, business executives lead largely by command and obedience, but if they would cultivate the next generation of business leaders, they must learn how effectively to persuade their juniors and colleagues. The so-called non-academic professions need people with enhanced teaching prowess.

If teachers accept it as part of their professional responsibility to develop all their students as teachers, then they will need to revise the way in which they set assignments and examinations and conduct their seminars. When students write examinations today in the humanities (I leave aside multiple-choice and true or false exams in which teachers systematically suppress the impulse to teach), they adopt a kind of Morse Code. They invoke terms; they signal words rather than arrange thoughts in intelligible wholes. Their bad writing habits do not merely reflect laziness. The very social setting of the examination tends to encourage an unrevealing shorthand. After all, students write the examination for the teacher whom they (sometimes mistakenly) assume knows more about the subject than they do. They want merely to prove that they know the subject; they do not attempt to teach effectively and imaginatively what they know. It may make sense on examinations and papers to ask students to assume that an intelligent but ignorant friend has put the question, to help them break out of constricting jargon.

The loss of their traditional preferred constituencies of pre-professionals and professionals may help teachers themselves to teach and write better. They will need to learn how to reach out to a largely non-professional audience. The discipline of sharing with these new constituencies may affect favorably their own teaching and writing, and, perhaps, if the foregoing is correct, even their grasp of their subject.

As humanists learn how to open up their subjects for potential lawyers, doctors, and other strangers, they may acquire a fresh grasp of their sources and resources. At a minimum, increased attention will have to be paid to the quality of their own writing.

The computer will not, in and of itself, produce these substantive changes for students and teachers, but it places this exciting reform in education within our reach.

c. Technology and the Content of Teaching in the Humanities. It would be foolish to restrict discussion to the impact of technology on the process of teaching. One must acknowledge as well its impacts on the society at large which eventually affect the content of teaching. The successes of technology are many, but at the same time, it has created a whole range of problems that surface almost daily in our newspaper headlines, such as toxic waste, acid rain, nuclear arms, the rapid dissipation of both non-renewable and renewable resources, and the dozens of impossible quandaries that beset the medical profession today. In their first reaction to these weighty problems students retreat into a privatistic careerism. "I can't do anything about it. So screw it. I'll take care of myself." Alexander Astin of UCLA states that all indices across fifteen years show student interest in public issues declining. This withdrawal of students from public to private life has impoverished what might be called the civic self. This withdrawal coordinates further with the positivist dismissal of moral judgments to the realm of the private, emotive, and subjective, thus providing an intellectual justification for the neglect of shared values in our common life.

. In the long run, however, this privatistic careerism may force us to rethink the content of teaching--better yet, the aim and intention of teaching. Oddly enough, it may lead eventually to the recovery of the classical mission of the liberal arts in the university curriculum. These ancient and honorable, but somewhat neglected, disciplines took it as their purpose: one, to cultivate critical intelligence, and two, to cultivate the civic self.

Since World War II, universities have tended to restrict their task to the training of technical rather than critical intelligence. Technical intelligence tells one how to get from here to there. Critical intelligence asks whether the there is worth getting to. It raises what has been incessantly called the question of ends or values. The modern positivist university has asserted that values are merely a matter of subjective preference and, therefore, do not qualify as a fit subject for critical study and judgment. (See Max Weber's classic essay on the issue, "Science As a Vocation.")

This positivist dismissal of values to the merely subjective prepared for a privatistic careerism in the student body. Since the university does not offer an area where reasoned discourse, debate, and discriminate judgments can be made on the subject of values without deteriorating into propaganda or advocacy, the information it offers is up for grabs to the highest bidder. Knowledge itself is a private property, not a public trust, to be sold entirely for private advantage. Who is to say otherwise? Certainly not professors who dismissed values as merely subjective. Thus the professional skills of students, finely honed in the descriptive disciplines, ended up for hire to further any and all private career aims.

We underestimate, however, the human intelligence if we assume that it can only give us information as to how to pursue ends but can raise no basic questions about the ends pursued, if it can bestow upon us techniques, but cannot subject to disciplined reflection and discourse the question of the ends which our techniques and technologies serve.

Second, our universities, if they would serve more than the privatistic career aims of our students, must help nurture the civic self. It must do so because modern technicians and professionals are, in effect, the new rulers in the west--they wield vast power in our society, a knowledge-based power. It is passing strange to have a ruling class without nurturing and cultivating a sense of civic responsibility in that class.

Ultimately, the nurturing of the civic self and the encouragement of critical inquiry belong to one and the same enterprise if value questions are not merely matters of private, subjective preference. To engage in critical inquiry is itself a social act that teases the mind out of the bottle of private preference and opens out toward a community of inquirers. We take our first stuttering moves toward citizenship when we can go beyond the bare ejaculations, "Well, I like this movie," or, "I don't like that play," and begin to offer intelligible explanations to our colleagues for our views. This kind of reasoned discourse tutors us in citizenship with one another. At its best, a liberal arts education is not a private transaction between the professor and her students. The classroom becomes a public place; the library, a commonwealth of learning; and critical inquiry among peers a kind of parliament of the human mind. Such critical inquiry is indispensable to technicians and professionals who have more than esoteric services to offer for private gain.

Will the computer itself assist us in addressing some of these problems, which technology and computer technology partly raise and with which the liberal arts must cope? Perhaps so--in one obvious, and in a second, relatively unexpected way.

First, one hopes that some problems generated by the mastery and control of the human environment will yield to yet furtner, more sophisticated technological interventions. The Romantics and Luddites among us scoff at this. They have reacted against technological triumphalism and grow skeptical, indeed cynical, about the optimistic assumption that technology has created no problem which it could not also solve. Still, one should not overlook ways in which technologists may learn from their mistakes. Computer studies of aerodynamics have helped design more fuel-efficient planes than their predecessors. The computer encourages letting form follow function instead of imitating old, pre-established, but inefficient forms. Older industrial technologies will give way to the less invasive and abusive subtleties of high-tech.

But computers may assist us also in a less expected way. Computers do not function simply as extensions of the human power to control nature, they also evoke in their users what Sherry Turkle of M.I.T. has called metaphysical questions and questions of one's own psychological identity. If Dr. Turkle is right, the computer may influence reflection in the humanities on some of the more enduring issues these disciplines face.

Turkle has observed that young users of the computer--six to eight years of age--are given at first to a kind of metaphysical animism. They impute human intelligence to the machine. This imputation provokes, in

turn, thought about the distinction between human beings and the machine. The very resemblance of the computer to human intelligence provokes fundamental thought amongst young and old on tne distinctively human. Interpretations differ.

Joseph Weizenbaum, fearful of the growth of instrumental reason in our culture--linear, logical and rule-governed thought--identifies the distinctively human with the ineffable, the uncodable, the uncapturable in language or formalist reasoning. John Searle argues that the computer follows rules which it does not itself understand. Human intelligence differs from purely operational, computational and manipulative intelligence by virtue of its capacities for self-reflection and self-understanding. Turkle, drawing on her studies of young children and their use of computers, locates the difference elsewhere. The machine doesn't have a mother; the machine doesn't suffer the experience of loss. Turkle writes:

> . . . we are born, we are nurtured by parents, we grow, we develop sexually, we become parents in our turn, we die. . . .A being that is not born of a mother, that does not feel the vulnerability of childhood, a being that does not know sexuality or anticipate death, this being is alien. We may be machines, but it is our mortality that impels us to search for transcendence--in religion, history, art, the relationships in which we hope to live on.[6]

I would add a further distinction between human reason and the computer--the human capacity to strike off a metaphor or simile; that is, to juxtapose two ordinarily dissimilar entities and to see them both better by virtue of that juxtaposition. This capacity to strike off metaphors lies at the root of our power to tell stories, and to traffic

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in images and symbols that shape our personal and collective lives. It would be foolish to argue that interaction with the computer for the first time uncovers the aforementioned distinctions between human beings and the machine. But widespread interaction may provoke the culture at large and the educational system in particular to think more deeply and afresh about these distinctions, and, to the degree that it does so, it may uncover and recover some of the intellectual resources which our culture requires as it faces the problems posed by abrasive technological change.

If Turkle can be credited, interaction with the computer not only augments mastery and provokes metaphysical questioning, it also provokes in adolescents (but also in others) a quest for personal self-interpretation, recognition, and identity.

At first glance this interaction would seem to lead in the opposite direction--to an escape from oneself and from others. Does not the computer already tempt young people only too bereft of social skills to avoid others? Will it not produce a generation of asocial computer hacks? Does it not encourage a narcissism, a withdrawal into oneself, accompanied only by the machine, precisely at that time in life when the student acutely needs to develop the social self or the civic self? Turkle's study suggests, however, a somewhat different outcome. The Narcissus myth need not lead inevitably to asocial, solepsistic withdrawal.

> There is another way to read the story. Narcissus fell in love with what appeared to him to be another. This image of that other person fascinated him because it objectified a sense of beauty of which he had felt only a vague inner

> sense. . .When you program a computer, there's a little piece of your mind, and now it's a little piece of the computer's mind, and now you can see it.[7]

This seeing of oneself at a little distance, in perspective, as it were, allows for a bit of self-interpretation, discovery of identity, and, in some touching cases, provides a clue to a new identity.

The computer itself provides metaphors for self-interpretation, in some cases optimistic, in other cases, pessimistic. Optimistic metaphors, such as "reprogramming" or, "getting the bugs out of the system," may, of course, deceive. They suggest that "painful emotional states--depression, inability to act, anxiety--are the result of purely local bugs,"[8] and thus they mislead about deep-going structures and syndromes. At the same time, the metaphor of the computer "loop" may deceive in the direction of pessimism; that is, the fear that the self is a "vicious programming circle where all paths lead back to the same unproductive starting point."[9]

In any event, let no one be deceived about the computer itself. It may not be able to produce a metaphor, but it fairly bristles with them in interaction with its human users. "Whether or not computer scientists ever create an artificial intelligence that can think like a person, computers change the way people think--especially about themselves."[10] Therein may be their last and finest contribution to the content of humanistic thinking and teaching.

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Footnotes

1. Daniel Bell, The Winding Passage, (New York: Basic Books, Harper, 1980) p. 7.

2. Benjamin Farrington, The Philosophy of Francis Bacon, (Liverpool: Liverpool University Press, 1964).

3. Ibid., p. 28.

4. Ibid.

5. Op.Cit., pp. 53-54.

6. Sherry Turkle, The Second Self; Computers and the Human Spirit, (New York: Simon and Schuster, 1984), p. 311.

7. Ibid., p. 155.

8. Ibid., p. 160.

9. Ibid., p. 161.

10. Ibid., p. 162.

BIOGRAPHY - WILLIAM F. MAY

Washington, D. C. -- William F. May joined the Kennedy Institute of Ethics, Georgetown University, in the Fall of 1980. He is the Joseph P. Kennedy, Sr., Professor of Christian Ethics there. A 1948 graduate of Princeton University, he received his B.D. magna cum laude (1952) and Ph.D. (1962) degrees from Yale University.

Before coming to the Kennedy Institute, Professor May served as the founding chairman of the Department of Religious Studies at Indiana University, and as chairman of the Religion Department at Smith College, Northampton, Massachusetts.

May is former president of the American Academy of Religion and is a Founding Fellow of the Hastings Center, where he co-chaired its research group on death and dying.

May has published essays on religion, politics and biomedical ethics. In addition to contributing chapters to a dozen volumes, he is the author of A Catalogue of Sins (Holt, Rinehart and Winston) and a monograph on Professional Ethics: Setting, Teacher and Terrain published as part of the Hastings Center project on the teaching of ethics in America.

The Indiana University Class of 1970 voted May a Distinguished Teaching Award. He has received post-doctoral fellowships from the Danforth Foundation and the Lilly Endowment, Inc. A Lilly Faculty Open Fellowship in 1976-77 permitted him to spend the year as an observer at the New York Hospital, where he became acquainted with the delivery of health care in a variety of institutional settings. He has taught summer seminars for physicians and other medical practitioners, under the sponsorship of the National Endowment for the Humanities, 1974-79, and seminars on management ethics, sponsored by the Yale School of Management, the University of Southern California and the Society for Values in Higher Education.

Wesleyan University invited him to be a fellow at its center for the Humanities (1974-75) on the subjects of "Art and Criminality" and "Terrorism as Strategy and Ecstasy." As a Poynter Fellow at Indiana University (1978-79), he wrote on "The Humanities and the Civic Self." Recently he served as an author and consultant to a National Science Foundation project on the "Ethics of Field Research in Anthropology and Sociology."

Dr. May received a Guggenheim Fellowship (1978-79) to work on the public obligation of the professional. Westminster Press recently published his book, The Physician's Covenant; Images of the Healer in Medical Ethics, November 1983.

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BAUHAUS EXPERIENCE:
A TEAM METHOD OF TEACHING TECHNOLOGY

by

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BAUHAUS EXPERIENCE: A Team Method of Teaching Technology

Eugene W. Balzer, Ph.D.
and
Patsy B. Reed, Ph.D.

In a recent television commercial, the Xerox Corporation projects the thought that their office system computers are better than other computers because of teamwork. Their name, Team Xerox, suggests a notable value to be attained from teamwork in this age of specialization.

Many aspects of modern technology are individual or personal activities rather than team efforts. Note the name of small computers, "Personal Computers."

At a recent tour of a computer chip manufacturing company I observed what I consider a serious industrial problem of today and if not changed a problem of the future. That problem is related to the hierarchy of jobs and various degrees of team work or lack of within the hierarchy. The employees at the assembly or inspection line level were assigned individual tasks to perform and were not considered a team, although there were 10-12 people working under a supervisor who was in charge of their total production. If one person were sick it was up to the supervisor to find a replacement. How easy it would have been to organize these workers into a team. The team could have helped in most decision making processes. As an example they could have determined how to creatively solve problems of training new workers, scheduling of vacations and etc. In other words they would be in control of themselves rather than be controlled by others.

Ironically the supervisors were involved in an education program that dealt in part with teamwork and the teamwork process at the supervisory level. As companies turn more toward industrial robots and robotics it becomes crucial that all employees become a functioning part of the team.

Universities are partly responsible for producing highly specialized graduates with limited experience in working as a team. A quick glance in any Community College, our University catalog will reveal specialty areas within each college. What are we asking

students to do? We are asking them to do individual papers, or projects. We then evaluate the individual paper, project or test. When the student finishes his/her degree we as professors are asked to fill out the standard recommendation form. A very important question on the form is "How well does he or she work with peers and associates?" We don't know because most of what we have asked them to do has been individual projects. The appropriate question is, "How do we teach the teamwork process to students in highly specialized fields of higher education.

The College of Design and Technology at Northern Arizona University, Flagstaff, Arizona is implementing, this spring semester 1985, a teamwork concept we are calling the Bauhaus Experience. The Bauhaus Experience is a historical concept that unifies function and design, and technology by establishing a group of talented artisans and technical experts to solve problems concerning all aspects of production. Architects Walter Gropius and Peter Behrens first expressed the concept in 1910 in Germany with their proposal for the "Industrial Prefabrication of Houses on a Unified Artistic Basis" in which they noted that solving problems on a unified artistic basis was a new move toward the syntheses of technology and art. By 1919 their concept had grown into the Bauhaus at Weimar in which Gropius coordinated the team effort of archigects, artists, craftsmen and technicians to design, produce, and market a wide variety of products including furnitre, textiles, dishes, and lamps. During the next two decades, the Bauhaus moved to Dessau and them Berlin, but was disbanded for political reasons in pre-World War II Nazi Germany. The Bauhaus concept of team cooperation and design has survived, and we to, hope to utilize the concept through which our students will work cooperatively to develop aesthetically pleasing high technology products.

A knowledge of the organization of our College is fundamental to understanding our ability to place this concept into operation. Our existing undergraduate programs are Interior Design, Construction Technology, Manufacturing Technology, Photography and Printing Technology, Fashion Merchandising, Dietetics, Foods and Nutrition in Business,

Home Economics Education and Industrial Arts Education. In analyzing our College, we found that we have a diversified faculty and student body in all of our programs who were engrossed in their own individual activities.

By using product development as our prime motivator, we are involving students and faculty from all of these programs in the Bauhaus Experience. This experience in its infancy is scheduled as an honors program, but later may be required of all students in our college. The philosophy for the Bauhaus Experience was stated as follows.

The College of Design and Technology at Northern Arizona University respects the unity of human needs, aesthetics and technological expertise as requisite to successful product development and is committed to collaborative efforts of faculty and students in the spirit of the Bauhaus. We regard a strong foundation of fundamental and technological knowledge as an indispensible base on which we can build a cooperative problem-solving charge with the goal of product development and related studies. To this end, we see a productive union with industry, business, government and education as essential, and we value intra- and interdisciplinary cooperation as paramount determinants of the effectiveness of unified endeavors.

Ideas for the products to be developed in this first Bauhaus Experience class have come from both students and faculty. It seems that just as the saying goes that everyone has at least one book in them to be written, people in all fields seem to have ideas on products to be developed and produced. Possible ideas are improved infant cribs to prevent accidental deaths due to mechanical or design problems, improved clean burning catalytic wood burning stoves, quartz halogen lighting systems such as desk and floor lamps, electronic signal systems worn by toddlers and mothers that would alert the mother if the child fell into a swimming pool, safety devices for industrial machines, modular hours construction as a replacement for mobile homes, and functional limited space dormitory furniture for college students.

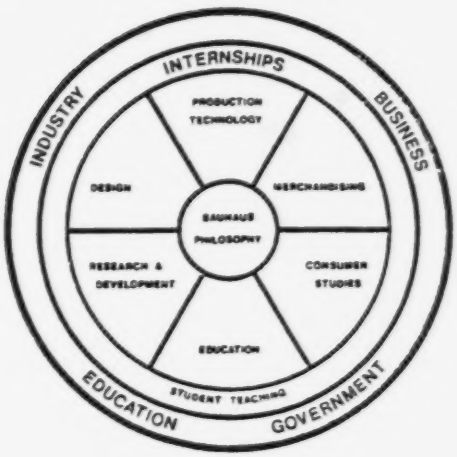
All product ideas will be reviewed by a council to see if they meet the spirit of the

previously stated philosophy. For a short term success product the limited space dormitory furniture holds excellent promise. This idea is a spin-off from furniture built by enterprising dormitory students. Each Fall semester students are seen constructing crude 2x4, and 2x6 sleeping lofts. The space gained by elevating their beds is then used as a study area. In a brain storming idea session it became apparent that this basic idea could evolve into complete sets of dormatory furniture. This would include beds, desks, chairs and wall storage units.

The phases of product develoment by the faculty and student team in the Bauhaus Experience regardless of the product are:

1. research and development; 2. design; 3. production; 4. merchandising; and 5. consumer studies.

COLLEGE
OF
DESIGN & TECHNOLOGY



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Allow me to talk you through the steps involved in this method of teaching technology. A long term project that would involve many of our faculty and students from most of our programs is the modular house construction as a replacement for mobile homes.

Research and Development: In the research and development phase, students, and faculty who may have release time from teaching would investigate the need for modular housing. In a preliminary investigation it has been shown that there is a definite need for durable low cost housing on the Navajo Indian Reservation. The ordinary box house provided by the government as low cost housing is aesthetically and socially not the most desirable Navajo housing. This research and development phase would also examine types of materials, feasability of materials for mass production, and the possible shape of the modular homes.

In talking with several faculty members the interest and willingness to cooperate on the modular housing project became apparent. Concrete as a building material was suggested and to aid in mass production the technique proposed was to make the concrete walls and forms an integral part of the finished home. In addition to the conversation about the concrete materials, another faculty member demonstrated interest in attending a construction convention. One of the main topics was concrete house construction.

By utilizing modular units for the walls, the finished house can take on many various sizes and shapes. An idea for the Navajo housing is to make the units into an octagon shape similar to their existing hogans.

Design: In the design phase both visual and mechanical factors are analyzed. The visual aesthetics of the design are blended together with the production factors. This is a critical point in the experience. It is the point where aesthetics and function meet. An evaluation factor is the construction of scale models and prototypes.

Production: The production phase involves the development of jigs and fixtures for

the actual limited production. Line production problems are solved by simulated computer programs and producing several prototype modular houses.

Merchandising: Merchandising involves the use of computer programs to determine the actual cost of producing the product, and the margin of profit and financial forcasting. In addition, a complete advertising campaign and methods of financing is initiated.

Consumer Studies: The consumer studies phase is a final evaluation of the product. It is when our college and outside people determine the value of the product. It is our hope that our products will be of such high technical and visual quality that industry, business, and government will be interested in purchasing the rights to the developed product.

Beyond the product we hope that the journey through the teamwork process has been a most desirable experience for our students, our college, and industries.

From the various activities involved in the Bauhaus Experience of product development, it can be seen that to have a completed product requires teamwork. Faculty and students will be drawn upon to lend their expertise in the various phases of the product development. Both will be involved in a creative, innovative, interdisciplinary method of teaching and learning. Like the Xerox Corporation thinking that their compurters are better because of teamwork, we feel that our students and faculty will benefit form the cooperative efforts of our Bauhaus Experience in product development.

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ADVANCE ORGANIZER: AN EFFECTIVE PRE-INSTRUCTIONAL STRATEGY

by

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ADVANCE ORGANIZER: AN EFFECTIVE PRE-INSTRUCTIONAL STRATEGY

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Abstract: This study examined the effectiveness of an advance organizer in teaching science with a film to college students and the interaction of an advance organizer and the ability levels of the subjects. The results indicated that the advance organizer increased factual learning and retention from a sound film when it was presented in advance of the film showing. However, no interaction between the advance organizer and the ability levels was found.

Teaching facts and concepts with instructional films is a widely accepted practice in the classroom. Teachers use films to supplement or enrich related learning materials. However, a host of factors including the sequencing and arrangement of subject matter, previous knowledge of subject matter and intelligence appear to determine what and how much a student will learn from a film. Therefore, a variety of strategies has been suggested to prepare the students for new situations and knowledge. These strategies included inserted questions (Kantor, 1960), film clips (Baldwin, 1968), introductions (Arwady, 1978), and summaries (Lathrop, & Norford, 1953). All of these techniques work with varying degree of success when the instructor has previewed the film in question. These procedures are not always possible with the present-day demands on the instructor and the requirements of film distribution.

There have been some suggestions that an advance organizer properly constructed and presented in advance of the film showing might lead to greater teaching efficiency (Chang, 1982; Bunson, 1978; Montano Medence, 1974). Ausubel (1978; 1963) proposed that cognitive structure could be manipulated to facilitate the reception and retention of new material. He suggested that special introductory passages which he called advance organizers could be employed to provide the learner with the appropriate

subsumers for subsequent learning tasks. Theoretically, the advance organizer provides concepts under which the details in the learning passages can be subsumbed. An advance organizer was initially conceived as a pedagogic device to be employed with written task. However, an extension of an advance organizer to film design and utilization was found various studies. Bunson (1978) devised a brief silent motion picture film and attached to the main body of the film that he used for his study in order to give a brief overview of the film content. He found that the advance organizer was effective in teaching the sixth graders with a social science film. Chang (1982) found that the advance organizer was effective in increasing the learning and retention of the consumer education film by the regular and educable mentally retarded children in a mainstreamed classroom.

This study attempted to verify whether a non-print advance organizer would raise the effectiveness of a science film when it was presented prior to the film showing to college freshmen. Specifically, this study focused on two questions. The first question was whether an advance organizer could aid in greater acquisition and retention of facts and concepts acquired from a science film than could be obtained without such a device. The second question was whether the use of an advance organizer would have a differential facilitative effect with groups of learners, namely, high ability group and the low ability group as measured by grade point average. A non-print advance organizer used in this study referred to a set of tape narrated 2"x2" color slides presented in advance of a sound film from which the slides were made to give a brief overview of the film.

Method

The subjects were sixteen undergraduate students. All subjects were white and primarily females who volunteered to participate.

A short version (twenty-three minutes) of the film, Birth of a Brain (1982), produced by Les Films due Levant was selected for this study. This film presented the prenatal and postnatal development of the human brain.

A non-print advance organizer consisted of two parts: one part was a series of 2"x2" color slides made from selected frames of the film, and the other part was a script written around the major concepts of the film at a higher level of generality, inclusiveness, and abstraction than the film script itself. A female read the organizer script onto an audiotape (2 minutes in length).

To obtain a learning test to provide information about groups and treatment differences, a pretest consisting of thirty-three items were given to fifty-one students enrolled at the same institution after they previewed the film in question. The final form of the five-option multiple choice test consisted of twenty-five items yielded Kuder-Richardson-Hoyt reliability estimate of .59.

A 2x2 factorial design was utilized with ability levels (high x low) and presentation modes (advance organizer plus film x film only) as independent variables, and the posttest scores as dependent variables. All subjects were assigned randomly to the four groups--two high ability groups and two low ability groups as measured by grade point average. Means of grade point average of each group on a nine-point scale were as follows: advance organizer group with high ability subjects (8.4); advance organizer group with low ability subjects (6.6); control group with high ability subjects (8.4); and control group with low ability

subjects (6.8). Each pair of the high and the low ability groups received one of the treatments: advance organizer plus film and film only. The learning test was administered to all subjects immediately after the film presentation to test the immediate retention and two weeks later for delayed retention. To minimize individual differences due to speed factor, no time limit was given for completion.

Results

An ANOVA (equal n) was performed separately on the test data obtained from the immediate- and delayed-retention tests. Sixteen observations were included in the final analyses. Means and standard deviations on the tests were presented in Table 1; and the results of the ANOVAs were reported in Table 2 and Table 3.

See Table 1, Page 48

The results of this study indicated that significant difference in learning and retention was found among presentation modes. The Tukey Test was then applied separately to the data obtained from the immediate- and delayed retention tests to determine between which means this difference existed.

See Table 2, Page 49

The results indicated that on the immediate retention test there was a significant difference between the organizer group with high ability subjects and the film control group with high ability subjects, and

between the organizer group with high ability subjects and the control group with low ability subjects. The difference between the means of other groups was not significant.

See Table 3, Page 50

The results of the analysis on the delayed-retention test data indicated that there was a significant difference between the organizer group with high ability subjects and the control group with low ability subjects, and between the organizer group with low ability subjects and the control group with low ability subjects, and finally, between the organizer group with low ability subjects and the control group with high ability subjects.

Discussion

The results of this study indicated that the non-print advance organizer prepared for this study appeared to provide facilitative effect for both the high and the low ability groups in acquisition and retention of facts and concepts presented in a science film, and ability levels did not differentially affect the learning outcomes. These results are consistent with the results obtained by Bunson (1978) and by Chang (1982) who experimented the non-print advance organizer with a social science film and a consumer education film respectively. Perhaps, a possibility that the better performance was simply due to being exposed to extra content material, such as an advance organizer, must not be ruled out. A meta-analysis review study indicated that an advance organizer showed a lesser tendency to facilitate learning when the control group studied the learning materials for a period of time equal to the combined time the

experimental group studied the advance organizer and learning material (Kozlow, 1978). It is interesting to note that no interaction between the advance organizer and the ability levels was found. Other researchers (Chang, 1984, 1982; Moor, 1982; Lucas, 1972) have obtained similar results.

Since the results of this study suggest that learners from a wide range of academic and intellectual abilities might benefit from the use of non-print advance organizers which provide the learner with conceptual relationship of the film content which is hierarchically arranged, this implies that the students may learn more and retain longer the information presented in a film if an instructor provides them with appropriate advance organizers in which new concepts are subsumed in an appropriate location in the learner's cognitive structure. Furthermore, the instructor might be relieved of the responsibility of always previewing a film before showing it to a class. Further research is needed.

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TABLE 1

Comparison of Means Scores on the Dependent Variables

A. Immediate Retention Test Scores

Group	Mean	S.D.
1[a]	15.0	2.16
2[b]	11.8	0.91
3[c]	13.0	1.15
4[d]	11.0	1.40

B. Delayed Retention Test Scores

Group	Mean	S.D.
1[a]	13.8	0.50
2[b]	11.0	2.45
3[c]	14.5	2.38
4[d]	10.8	1.89

[a]Advance organizer group with high ability subjects

[b]Control group with high ability subjects

[c]Advance organizer group with low ability subjects

[d]Control group with low ability subjects

TABLE 2

Results of ANOVA on Immediate Retention Test

SOURCE OF VARIANCE	SS	df	ms	F	p
Presentation modes	27.57	1	27.57	12.36	$<.01^{**}$
Ability levels	7.57	1	7.57	3.39	n.s.
Ability x Modes	1.55	1	1.55	0.70	n.s.
Within groups	26.75	12	2.23	-	-
Total	63.44	15	-	-	-

TABLE 3

Results of ANOVA on Delayed Retention Test

SOURCE OF VARIANCE	SS	df	ms	F	p
Presentation modes	42.25	1	42.25	10.89	$<.01^{**}$
Ability levels	0.25	1	0.25	0.06	n.s.
Ability x Modes	1.00	1	1.00	0.26	n.s.
Within groups	46.50	12	3.88	-	-
Total	90.00	15	-	-	-

TEACHING, TECHNOLOGY, AND THE MEDITATIVE PAUSE

by

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TEACHING, TECHNOLOGY, AND THE MEDITATIVE PAUSE

Because I want, a little later, to caution us all against a peril against teaching contained in the nature of some technological change, I should declare at the outset that I'm not inevitably on the side of the past. Television, word processors, and computers are not the instruments of the devil. He'd be safe, too, if the devil should take up video games: he'd be too busy to go about his customary satanic rounds and to do his regular satanic mischief. The word processor I am acquainted with and I sometimes square off against each other, and I lose. It has, so far, eaten three papers, two desk blotters, and one necktie. Nevertheless, I think I enjoy most change: I like the coffee pot that keeps my coffee hot without my chopping wood and tending a fire, and, if presented a choice between indoor and outdoor plumbing, I think only the innocent or the masochistic would have any trouble choosing.

The spectacle of rapid change is interesting to watch, and I can usually manage to enjoy it. I do, however, want to raise some cautionary signals. I think we should remind our-

selves that most changes aren't pure. That is, as I'll try to show later, even the best changes are sometimes mixed with bad, particularly in the loss of some former good. I think, second, that we should notice that we are,oftener than not, focusing too exclusively on computers and word processors as agents of change. A hurry is on us to become "computer literate" and otherwise ready ourselves for tomorrow. The catch is that tomorrow and the day after are already here with some changes we haven't taken time to notice and to understand sufficiently. Rapid change has come before, and we have missed in our focus. We cite, rightly enough, the development of the printing press as the beginning of great change, but we forget that nothing like mass communication was possible until expensive silk paper had been replaced by relatively inexpensive wood pulp paper, which is what really released the print explosion in the 18th century. And now, we fail to take notice that the computer is not uniquely responsible for the so-called "information explosion" with its potentially great benefits to teaching in the late 20th century.

I am puzzled when I note that the terms LOW TECH and HIGH TECH have been appropriated for use almost exclusively in talking about <u>computer</u> technology. A university can have five large buildings filled with the most incredibly sophisticated kinds of technological equipment for use in the study of biology, chemistry, physics, geology, and other subjects, and still be regarded as a LOW TECH school unless it has the right kind of main frame with 1257 K power and 902 outlying terminals

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attached to it plus any number of silicon chips and buffalo chips. I suppose it's because computer technology is so new to us and seems to have such diverse applications that it overwhelms all talk of other technologies.

To be sure, computer technology has brought with each stage in its development marvelous changes in its capacities and in ours. In my own field, two journals, College English and College Composition and Communication, have already begun publishing papers about the uses of word processors in revising written work and about other uses of technology in remediation and in dealing with particular problems in writing. I'll digress a moment to say that better machines probably won't make your students much better as writers. The evidence is before you every day in your daily newspapers. Most newspapers are long since equipped with video display terminals and word processors, but your daily paper probably doesn't read much better than it formerly did. Better machines probably won't make students better writers; better teaching better equipped will.

At any rate, I think we need for a moment a different perspective that will let us see that computer technology, while central, is not the only technology that will influence us for good or bad as teachers, a perspective that will let us see that no mechanical change is un unmixed good.

A little earlier, I said that the computer is not solely responsible for the information explosion that continues to detonate around us. In this country last year, about 40,000

books were published; over 25,000 periodicals, about 1300 daily newspapers, some 3000 weekly newspapers were also published. About 7000 radio stations and some 1000 television stations were broadcasting, and about 13,000 films (counting all kinds) were made. But even if we consider machine technology alone, the computer alone is not responsibile for the explosion we see and hear--electric typewriters and photocopying machines have done their part, we can be sure.

Nevertheless, HIGH TECH is the issue, and to most, that means computer technology, together with other electronic communication systems that are developing. Every day we are being startled into self-consciousness by signs of rapid technological development as first one corporation, then another, first one university, then another announces surprises. Where rapid development does not yet reach, it is longed for. In an age of technology, technological development is the signal of civilization, the path for aspiration, the sign of superiority. All ages, to be sure, are technological ages in one way or another, but in former ages technology has commonly moved more slowly so that it was possible for us to accumulate gradually its appurtenances and methodologies. Modern technology, however, does not offer us a tool at a time to adjust to slowly; instead, whole systems of method open up to us between the time we leave off schooling and take up working. Our way is technological, and it is rapid, and we accept it as appropriate. It isn't always.

Increasingly sophisticated technology is not an unmixed blessing. Few advances are. The typewriter is undoubtedly a blessing, but it may be responsible for the general shortening of our sentences, where a quill pen might have encouraged slow meditations prior to writing, longer sentence building, and sonorities that we seldom hear now. Nevertheless, we do have to consider how thoroughly the students who come to us already live within an information system, or soon will. In 1978, Rep. Lionel Van Deerlin, chairman of the house subcommittee on communications, predicted that the new video options will "transform not only the face of broadcasting but the lives of Americans as profoundly as the Industrial Revolution of the nineteenth century." The optical fiber developed by Bell Laboratories is designed to be folded into a telephone line so that a single line could conceivably provide all of a family's phone messages, a multitude of TV shows, and, if linked to a central computer bank, a vast range of domestic services. The students who come to us will increasingly be familiar with a world that includes fiber optics increasing the channels on a television set a hundredfold, two-way cable television, satellite transmission, home video recorders, video disk players, portable video cameras for home-made productions, electronic data transmission that gives viewers the ability to call up on the screen a wide range of material, including news reports, market information, or reference material from an information bank. We're not, of course, beyond confusion in all of this. For

example, there is already confusion in regulations: if one sends a message by phone that results in hard copy at the other end, is that a phone service or a mail service? The Federal Communications Commissions and the Postal Rates Commission sued each other to find out.

But I must turn to where I wanted to be from the beginning. There is another line of revolutionary technological development that we have not considered sufficiently. It is as significant as the changes brought about by computers, in some ways perhaps more significant. The changes it brings, like those effected by computers, are not unmixed goods. I am referring to the various processes of minaturization made possible by developments in high reduction photography. I will, in what follows, refer only to technology that already exists.

Microfilm was the herald of a new age in miniaturization. High reduction photography has, however, gone much further. The first stage was the development of microfiche, which made it possible to put an entire book on a single small film card. Then supermicrofiche made it possible to pack 1000 page images into the space provided by a single 3" x 5" film card. That's the equivalent of three or four fair-sized books. Then reader-printers were developed that would make hard-copy printouts of any page or pages, bringing them back to approximately their original size. Then ultramicrofiche was developed, making it possible to put up to 3200 pages on a single film not much

larger than a large postage stamp. That's roughly the equivalent of seven to ten fair-sized books. Some years ago, Encyclopedia Britannica, Inc., offered for sale its first supermicrofiche collection, the Library of American Civilation. It contained 20,000 volumes numbering about six million pages, which on first sale went for $21,000, as opposed to the roughly $450,000 then required to buy the actual books. The books would require about 2000 feet of shelf space; the supermicrofiche collection requires 32 small card trays. National Cash Register Company now has some 70,000 volumes ready on ultramicrofiche, requiring still less space. Meanwhile, high reduction photography has also made it possible to store representations of about 8000 paintings on a single video disk.

Now if we add to the process of miniatruization the concept of networking, long since possible, we can imagine still more remarkable things, though we don't have to imagine them, for the technology already exists, though it is certainly not yet universally available. Such a scene as the following is already possible. Imagine one of our students in a dormitory room. He or she needs to study some particular subject, or needs to do a particular research project. The student goes to the console in the dorm room, summons up the attention of a machine in the university library, and tells the library machine to search out the pertinent materials for the subject or research project. When the library system has done so, then, at the student's pleasure, the material can be sent to the dorm room either on

the screen or in hard copy. Portable sets, with console, screen, and printer--the whole not larger than an attache case--are also available, so that a student may have a convenient study center just about anywhere he or she pleases. If the student's own university library does not provide enough material, then he or she can ask the library system to search out other libraries, including the Library of Congress and the British Museum Library, with the material to be sent either on screen or in hard copy. Searching other libraries, however, may not be necessary. With the developments in miniaturization I mentioned above, it will be possible for <u>any</u> library to have <u>all</u> libraries stored away on ultramicrofiche.

This, I submit, is potentially a far more revolutionary development than the development of a computer that can store thousands of pieces of information and rearrange them on call or do 12,000 numerical operations in a second or two. Storing is storing, and numerical operations are numerical operations. Such computer actions make for a more rapidly-moving world, but I think they do not change the actual nature of the world. The miniaturizing and networking operation described above does, I think, induce some changes in the nature of things.

If our students' consoles connect them to the world's entire resources, how are they to go about their study? How are they to choose? Where are they to start? Where can they possibly stop? Can they study these resources in the same way they would if they were reading books and journals? By their

size and nature, books and journals invite readers to pause, to re-read, to look ahead, to ponder; a terminal connected to all of the world's resources invites readers to keep going, as fast as possible, for there is always more to come. Does one kind of study entail the same kind of thinking that the other kind does? Probably, almost certainly, not.

Before I begin to sound too nervous about these changes, I should stop to declare that I do know these changes offer great bounty, incredible bounty. No teacher, I think, would have to be taught to be grateful for such bounty. Any school, any little town, can have a great library and, with those video disks, a great museum. But as I have frequently said, few great changes bring unmixed good. In the midst of this bounty, there is also potential loss. The machine giveth, but the machine also taketh away. What seems like bounty can, in no time at all, seem like hopeless clutter. It's like my closet: there's so damned much there that I can't find anything. But something else waits, too, something potentially more perilous than clutter.

If we go into this new and bountiful world, we will gain great good; but unless we discriminate, we will lose great good as well--good that we cannot afford to lose and should not want to lose. Some of the offerings of machines today and hereafter are good--speed, accuracy, reduced drudgery, efficiency, plenitude. But some are also antagonistic to certain virtues we have long held dear. I want to single out one great good that seems threatened by the wildly multiplying resources presented to us by

some of the changes I have mentioned. The goal I am talking about is the ideal of the examined life. It may seem paradoxical to claim that the technology that seems to offer more and more learning and experience works against the hope of an examined life. But I think it does.

Perhaps I can explain myself in this way. All of our forms of criticism, judgment, evaluation, and theorizing rest upon our ability to pause--that includes philosophy, scientific theory, literary criticism, social commentary, art criticism, music criticism, historical writing, and so on. None of these is possible without meditative pauses. To know a building's architectural character, we must look and pause and look again. To formulate a scientific theory, we must think and test and pause and think again. To know the nature of a poem, we must read and pause and re-read and jump ahead and pause and read again. But electronic devices promise speed, near-simultaneous answers to our questions, and--with the aid of high reduction photography--a perpetual openness to a multitude of experiences and evidence. Electronic devices will not become more primitive. They will become more sophisticated and more accessible to us all--provided, of course, that electricity keeps coming to the plugs in our various walls. All the more recent forms - movies, television, ultramicrofiche's green shadows flickering on a screen--doe not allow the same kind of meditative pause that print allows. Of course, when you use a movieola, it is possible to study a film frame by frame, but when you do that, you're no

longer studying motion pictures. Print allows us to turn backward or forward, to stop, to finger, to re-read. We may soon be able to do that with electronic communication devices, but it is their nature to move, to keep going. In our experience with electronic communication devices, the need is to hurry, to plunge into experience, to expose ourselves to as much as possible.

But we must pause. We want to lay ourselves open, to expose ourselves to an ever wider and deeper range of experience and information, to plunge, to turn on, and on. Yet if we are to be human, there comes a time to stop, to pause. If we commit ourselves to the hurrying world of electronic devices, then sooner or later, if we remain open to a life of multitudinous, whirring experience, we cannot and will not make judgments, we cannot have priorities, we cannot act, we cannot speak. The examined life requires both openness and closure. We educate our choices by an openness to earth and all, but then, as we are human, we pause, judge, speak, act, and start anew to educate our choices.

I'm not here, I hope you will remember, to curse change. To be sure, it does sometimes seem that when everything is available, it's just about as hopeless as when nothing in available. To be sure, the sheer copiousness of information can make it seem that we must hurry on and on and be swept in a swirl of clutter. It needn't be that way if teachers remember that we must stop and be human. I don't have to accept and to enjoy all change, but as a school teacher I do have to see to it that as

far as it is in my power, any student will have the chance and the ability to consider and to evaluate and use all change. If I'm good at my work, most of it will become obsolete.

That makes the future risky. It's always asking us to become something we are not. At any given moment, the future can look look grim and difficult to cope with. Indeed, since going into the future means becoming something other than what we are now, it can always look grim unless someone makes it look otherwise. A future always happens; a good future has to be made.

Future-making is teacher's work. Wherever he or she happens to be located, whatever he or she happens to be called at the moment, it's always a good teacher, not technology alone, who helps us make the future. Some teachers, of course, just keep reiterating the past. Some simply grab the prevailing fashions of the present. Good teachers make the future by thinking, not by piling up data. They know, I think, that if we lose the meditative pause, we will have lost something dear and that, for good or bad, we will become something quite unlike ourselves. That may be all right, but we must pause to know whether or not it's all right. Because we are mostly pretty complex, we are easily lost to each other. Sometimes our vanity teaches us that other people are only what we perceive them to be, and we lose each other by our ignorance, our unwillingness to search each other out and to know each other. Sometimes we are apart, sometimes forlorn, sometimes afraid, but a good teacher can teach us to

learn from others, to take the encouragement we need from others, to plug into distant and mysterious terminals, and all the while to pause, to ponder, to think.

A good teacher can teach us to know that each of us is blessed with a startling gift: each can be his or her own advocate, judge, critic, spokesman. A good teacher can teach us that change did not cease when it reached us, that we can go into a new world clasping to our memories what was dear in the old, but expecting to make magic hereafter. A good teacher can teach us that it is all right to question orthodoxy, that everything is full of wonder if we watch, that creation is too rich and varied and copious to be comprehended by single visions, that we must see and hear those visions from distant terminals, that we must then and always pause to think and re-think. There are many ways of looking, and a good teacher can show us many visions, each holding something precious and dear, that we must pause to consider and not accept simply because they come to us on the newest wire from the farthest terminal. Good teachers have the surest, boldest, loveliest validation for their work. Teaching by its nature takes hold of the past in order to proclaim and to create the future. However dark the time may be, however many signals reach us from distant electronic storehouses, it is good teachers, not technologies, that are always making the future. When they refuse to lock themselves into some pattern of the past, when they refuse to acquiesce meekly in prevailing

fashions or technologies, when their own behavior is self-luminous because they race to learn but pause to know and to teach, then good teachers will teach us to make a brighter future than any we can no imagine.

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THE CONCEPT OF THE RIO GRANDE INSTITUTE

by

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THE CONCEPT OF THE RIO GRANDE INSTITUTE

The issue which I shall discuss today is the growing need on campus to deal with convergences of the various intellectual disciplines at the frontiers of research. This is a subject which is widely recognized and discussed with respect to activities in applied science and technology but which deserves much closer attention in basic research. I shall describe a new concept in graduate teaching and research, the Rio Grande Institute, which is designed to help meet this need and which will address opportunities and problems arising from the increasing involvement of science in all aspects of society.

It is useful to begin with a consideration of three types of research organizations with different objectives and research styles. Industrial laboratories are designed to carry out interdisciplinary development on relatively short-term projects with tangible outputs. They depend on groups of engineers and applied scientists who pool their skills to achieve practical objectives. In contrast, academic research groups focus on basic understandings of theory and process. Interdisciplinary research is not common in such groups. Los Alamos exemplifies a hybrid of these two types. It is a government-owned, contractor-operated ("GOCO") laboratory. Its activities range from basic research, appropriate for any top-level campus, to very applied programs, not greatly different from prototype production efforts in industry. The Laboratory also conducts extensive field operations. I shall discuss it a little further because it spans the full breadth of research styles.

At Los Alamos it is necessary to create and manage team enterprises using personnel who are, in many cases, academically oriented. Success commonly depends on development of basic theory. Identifying and motivating the necessary scientists, frequently people who are highly self-directed, can become crucial. Most mission-oriented laboratories look to academia for this part of the job. However, the long-term, risky nature of the typical Los Alamos mission requires placing special emphasis on devising effective ways to conduct interdisciplinary research with the kind of scientists who can satisfy these special requirements.

Top-level scientists who place great value on self-direction tend to pursue their careers in academic research groups and usually avoid teams. There are, of course, examples of team research in academia, for example, the large groups of academic scientists that typically carry out experiments in high energy physics. However, academic teams are usually dominated by a single scientific discipline. They involve the engineering disciplines as leaders only in highly applied research centers. Generally, the traditional autonomy of academic research helps to discourage broadly interdisciplinary efforts.

In recognition of this problem, it has become increasingly common to establish interdisciplinary research centers on campus. Most

of them emphasize applied science and technology but a few conduct basic research. Such truly interdisciplinary basic science centers encounter serious problems which appear to stem largely from the traditional discipline-based structure of their home institutions. They have little influence on teaching policy and are not regarded as central activities. The departmental paths to tenure and recognition remain unchanged. The junior faculty can easily jeopardize their academic careers by moving to interdisciplinary borders, to "queer" subjects. It seems quite unlikely that these problems will be solved within a conventional academic framework.

Recently, additional sources of money have become available from the National Science Foundation and a few other federal agencies for the establishment of interdisciplinary centers with engineering themes at selected universities. An important objective in these centers is to close the gap between the academic and industrial styles by promoting a more collaborative team approach to some aspects of applied science. It is likely that useful progress will be made although the problems of brokering high-level scientific collaborations on campus may be considerably underestimated by academic administrators. Nevertheless, a new and imaginative effort along such lines is necessary and timely.

The present situation can be summarized as follows:

> Each of the types of groups or laboratories we have considered is presumably competent to plan interdisciplinary research within the context of its own programs and interests. However, interdisciplinary programs are usually undertaken when the team is mission-oriented and the desired output is well-defined. Such programs are characteristically industrial and are largely staffed with engineers and applied scientists.
>
> National laboratories usually are assigned longer-term programs requiring significant inputs of new knowledge derived from basic research. Their professional staffs include scientists who conduct the necessary basic studies. Such organizations can provide a very rich environment for nurturing effective interdisciplinary collaborations. But it is difficult to mandate interdisciplinary collaborations in basic research. Industrial management techniques become inappropriate and have been successfully modified at very few laboratories.
>
> The more advanced the interdisciplinary research area, the more likely it is that the individual parts will be pursued in an academic style, usually fragmented among the disciplines and scattered among various campuses. Occasional efforts at communication between disciplines occur at workshops and conferences with broad agenda. The yardsticks of success on campus are excellent students, superior

intellectual output, and peer approval. In such an environment interdisciplinary organization is not likely to flourish.

Given this situation, is there any compelling reason to propose new options in our current research structure? The traditional way to pursue basic research has worked so well that it almost demands to be left alone. Certainly, if anything new is to be done, it should not weaken the present system. Accepting the constraints implied by this caveat, I believe that a serious deficiency exists in the conduct of advanced interdisciplinary research and that additional options are badly needed. Ironically, the problem derives its urgency from the very successes of modern science.

Striking convergences in the traditional disciplines are occurring at an accelerating pace. Rich new subjects are emerging, representing in many cases wonderful opportunities for vitally important research. These subjects appear to be highly interdisciplinary in traditional terms although they do not join the whole of one discipline with another but link particular subfields. The parts shift and change, constantly forming new patterns. The subject matter is usually categorized as basic research and choices are made and pursued by highly talented individual investigators. The contribution which is made to a common theme by one discipline tends to be uncoordinated with related work in other disciplines and is not likely to be quickly available outside the usual publications within that discipline. Sooner or later connections are made. A growing pattern of such connections defines an emerging synthesis. Frequently these syntheses can have important effects on society.

We feel a sense of urgency in devising new ways to nurture emerging syntheses because the international competitive environment has shortened the time frame for developing those aspects of science which are important to our economic strength, physical security, and national prestige. The length of time required to make the transition from a basic scientific discovery to a tangible payoff is constantly decreasing and it can no longer be safely assumed that the United States will lead the way. In addition, the sheer dramatic and intellectual appeal of scientific frontiers can affect the nature of our society. The growing circulation of science-oriented publications is not based on economic or military considerations but is probably evidence of an increasing ability to understand science at a popular level. Greater public understanding of science can contribute enormously to responsible policy-making.

The organizers of the Rio Grande Institute are proposing a fresh, unconventional approach to education and research on a new campus. The Institute will have a number of objectives, not always fully compatible. We are attempting to create a graduate teaching and research school which can better deal with the problems discussed here. The Institute will focus on selected interdisciplinary

themes across a broad spectrum of scientific and social interests. It will address issues arising from the growing complexity and reorganization of major aspects of pure and applied sciences and their relationship to issues confronting modern society. It will reexamine the familiar problem of depth versus breadth in the education of professionals. The curriculum will reflect the expectation that some of our graduates will become leaders in government and industry.

The Rio Grande Institute will not provide the general course work that the typical undergraduate requires and it will not award a bachelor's degree. It will not have formal departments and will not emphasize full-scale lecture courses. Teaching will be accomplished in seminars, single lectures and short series of lectures, and above all by means of apprenticeship and research. Only the Ph.D. degree will be awarded, both in traditional and interdisciplinary subjects if they have become part of the Institute program. Faculty members learned in particular subfields, many with strong interdisciplinary interests, can be appointed without requiring balanced representation in the other traditional subfields. Research groupings will form according to the intellectual interests of the faculty and may vary with time. Only private funds will be sought for capital endowment of the Institute. Over a period of several years, as sufficient resources become available, it is proposed to appoint approximately forty senior resident faculty, some twenty non-resident fellows with qualifications comparable to those for senior resident faculty, some hundred junior faculty, tenured and tenure-track, and numbers of visitors and postdoctoral fellows. The student body will consist of some three hundred students, selected for their exceptional abilities, including the potential to benefit from an unconventionally structured curriculum and educational program.

In the immediate future, the Institute will initiate a program which merits support independently of its relationship to the eventual creation of a full-scale teaching campus. This program has the following features:

1. Emerging syntheses in science will be identified to which two or more disciplines can make significant contributions and which involve several people of great talent representing the contributing disciplines.

2. The principals will help form a "network" of appropriate members, perhaps twenty in number, who will conduct mutually supportive research in each of the important disciplines involved in the emerging synthesis. Some members of the network will work in part-time residence at the Institute; most will maintain full-time residence at their home institutions.

3. Some additional resources will be made available to members of each network, including the means to maintain

continuing communication through workshops, exchanges of campus visits, teleconferencing, and electronic mail distributed through networked personal computers.

Over a period of several years, this program will permit us to identify the most productive emerging syntheses. These will become major, continuing themes of the Institute and appropriate permanent staff appointments of senior and junior faculty will be made. We plan that by 1990 the Institute will be housed on its own campus and will be well started toward full-scale operation.

REACHING FOR THE POTENTIAL

by

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REACHING FOR THE POTENTIAL

Paul R. Dingman, Ph.D.

This discussion will view the goal of teaching to potential as being approachable via potentiation of the learner. This will require examination of three major variables: students' motivation, teachers' goals and teachers' power. In part, this may be done by comparing educational systems with economic systems.

Economic activity involves:

I. Capital, that is, unconsumed resources, in the form of savings, windfall acquisitions, or whatever. Unconsumed resources are used to secure whatever is needed for production. Capital can be land, structures, material, machinery, systems and knowledge, skills, and labor if stored up. Without capital, no productive activity, except gathering or hunting could take place. There is some question whether even gathering and hunting could be done without unconsumed sources, such as baskets or pots for gathering or rocks, clubs, or spear heads for hunting, and so on.

II. Labor, human effort applied to productive enterprise.

III. Management, the applying of capital and labor to productive enterprise.

IV. And finally, the one who uses the product or service. That could be called user ... but that has a

negative connotation these days. A client? ... that's pre-empted by lawyers, social workers, and some psychologists who are afraid of psychotherapy, and maybe beauty parlors. Patron? ... that's pretty much reserved for the arts. So, we'll call it consumer.

It has been imagined that these components can be assembled hierarchically. Capital orders or directs management. Management orders or directs labor. Labor, or course, orders nobody. In the opposite direction, labor is responsible to management to produce, and management is responsible to capital for labor's production.

Where does the consumer come in? That's never been too clear. There have been radicals who thought the consumer might order capital to order management to do this or that. Chrysler showed how foolish that notion is. In the free American economy, capital is free to make whatever it feels like making, and government protects it from ... whoops ... errors. (In the Northwest, that is spelled WPPS, for Washington Public Power System).

The hierarchic conception of capitalism is only a few hundred years old. There is some question whether it ever was highly efficient. It was, after all, taking over from feudalism which was even less efficient. Perhaps, in years past, rapid expansion masked its inherent lack of utility. In any event, its flaws are now quite evident.

This has led to the emergence of a phenomenon most recently called "participative management". It is generally credited to the Japanese but there is some suspicion that they got it by reading old U.S. psychology texts. At any rate, participative management is now spreading through the United States--even to the stuck in

the mud automobile industry.

Participative management certainly is more effective than hierarchic management. Not because it's a step in the right direction, it is not. Rather because it is a step sort of parallel to the right direction. It's not a step in the right direction because it still retains the notion that management "motivates" workers through arcane psycho-sophisticated manipulation.

There is some good news and some bad news about that. The bad news is that in truth, one cannot motivate workers. That is a fundamental psychological and economic law. The good news is that motivating workers is entirely unnecessary.

The reason it's unnecessary lies in one of the western worlds' best known secrets. Yes, everyone knows it. It is a secret only in that almost no one wants to admit to knowing it, much less to permit it to influence action.

The good new is that work is the human's single most important source of pleasure. (A detailed discussion can be found in Dingman, Paul R., Work and Psychological Well-being, A Theoretical Framework. Paper presented at Annual Meeting of American Public Health Association, Chicago, 1975.) It doesn't matter that people cannot be motivated to work because motivation to work is born in. One can permit people to work. One can provide tools, materials, etc., but one cannot motivate. Humans tend to work spontaneously unless prevented from doing so.

Understanding of this has made possible the emergence of "dofer" management. In these systems, the effective manager is at once an inspired, indomitable leader and a dedicated, reliable "dofer", that is one who considers "doing for" a noble activity. The good "dofer" puts own personal resources into action in representing the needs,

the interests and the wishes of those being "did for".

Each other component of the system; capital, labor, consumer, recognizes the necessity for modifying or tempering some aspects of its initially perceived needs in the interests of developing a viable system. Each then instructs its "dofer", the manager, in making necessary modifications. The manager does for labor by insuring ready access to everything necessary for working, including intangibles, such as requirements, and goals, such as consumers to be supplied; does for capital by insuring that unconsumed resources increase rather than decrease; and does for consumers by providing adequate supply of high quality goods or services at minimum cost.

The effective manager strives to be in spirit the faithful "dofer" of each, taking care also that in outward visible action each can see its own faithful "dofer" at work (A more detailed discussion of the "dofer can be found in Dingman, Paul R., The "Dofer", a New Look at Management Style. Paper presented at Fall Conference of the Oregon Psychological Association, Kaneetah, 1984.)

Many universities can be translated directly into the hierarchic management model. Capital is represented by the trustees, management by the president and administration, labor by the faculty, and consumer by the students. The basic product is considered to be instruction. Major problems are: increasing production of instruction; reducing unit cost of instruction while maintaining quality indices, such as number of faculty doctoral degrees per square student; finding student consumers, and once signed up, getting them to make use of instruction. Finding a technically qualified labor force has not been a problem for some time now.

Quality of life in such universities is, at best, poor. Instruc-

tion is seldom inspired and often barely acceptable. That some of their students ultimately do well and make contributions can only be attributed to the fact that no school can keep one from learning, it can only make learning difficult.

Hopefully more typical are universities which fit a participative management model. Capital is again represented by trustees, labor by the faculty, consumer by the students, and management by president and administration. The latter, however, conceives of themselves as partners with the faculty. Well, maybe senior partners.

These systems are far more effective. Quality of life is good, they provide good quantities of good quality instruction. In all respects, they are superior to those previously described.

Still they are characterized by student bodies which can be charitably called "uninspired". These educational programs are mediocre ... not bad, just mediocre. They cannot achieve excellence because they have misapprehended the nature of the product of an educational system. Instruction is not an appropriate end product. Instruction can achieve excellence only in the context of concrete tasks to be performed. Learning is the proper product of an educational system.

In discussing motivation and work earlier, the term "work" should have been defined. Let us digress here for that purpose. By work is meant any purposeful application of personal resources toward a productive goal. That implies that an economic good is intended, but not necessarily one to the immediate advantage of the worker. Pay is not a part of the definition, not is "job" synonymous with "work". Indeed, much work goes on outside a job context, and there are jobs which do not permit work.

(Calling unpaid workers "volunteers" is an odd usage. It suggests

that those who are paid are conscripted, forced into work.)

Obviously, learning can be subsumed under this usage of work, Learning is the principal work of the very young. All that has been said about work may be said about learning. That includes motivation. Motivation to learn is born in. Humans seek to learn, strive to learn, unless or until prevented from doing so.

(Work and play may be difficult to differentiate both in principal and in practice. Absence of economic gain, as in working a crossword puzzle, is typically the clue to play. Many activities involve both non-work and work, sensual experience and productive goal. Pottery might be an example. In some work activities, the goal is not tangible, as in skill acquisition or improvement.)

To return now to learning as the product of an educational system. Learning is the work of students. Students are analogous to labor in an economic system, and cannot be conceived of as the ultimate consumers. Society at large better fits there, but detailed discussion of that point will be deferred. The trustees may still represent capital, or at least access to capital, in our economic analysis of a university.

Faculty and administration then, jointly fit the role of management with administration properly being but a specialized offshoot of the faculty function. In those schools where administration has more bodies and a higher payroll that may be difficult to remember.

With this analysis, the application of the "dofer" management model is straight forward. The faculty is the "dofer" of the university. It does for society, the consumer, by ensuring the production of quality learning at minimum cost. It does for capital, the trustees, by

assisting in the attracting of unconsumed resources and in balancing resource reserves.

With respect to labor, the students, the "dofer" provides everything necessary to produce: workspace, knowledge, skills, systems, tools, whatever may be needed for learning. Faculty is management, the servant of all components.

Of course, administration has carried out many activities traditionally associated with management, such as handling money. For that reason, it may be difficult to remember that administration in this management model is deputy, a subsidiary, of faculty in the servant-manager function.

Returning now to the means of potentiating the learning and our concerns for students motivations, teachers power, and teachers goals. We have already noted that motivating students to learn is unnecessary. Motivation to learn is inherent in the make-up of the human. Our task as teachers is to permit students to learn. Simple in principle, but somewhat difficult in application because most have been taught from childhood not to learn. Curiosity outside specified narrow areas is a punishable offense in most homes and in all kindergartens, elementary, and secondary schools.

"Do not ask about reproduction."

"Do not ask about far eastern religions."

"Do not ask about errogeneous zones."

"Do not ask to learn how to make explosives."

"Do not ask about bugs, slugs or toads."

"Time enough for such questions when your're older."

"You may not fool with geometry now. That belongs in the tenth grade. You have to have introductory algebra first."

"You may not look at algebra until you prove you can recite

arithmetic."

"You may not learn comparative anatomy until you pass introductory biology."

Small wonder that most arrive at our university doors having forgotten they ever wanted to know anything. Small wonder that most are willing to be taught the requirements for entry into a particular profession or occupation but show no interest in learning. Small wonder that the dissertation with its suggestion of independant learning is apprehended with such horror.

Given such circumstances, how can we serve students that they may under take learning?

We could start by tempering our pride in our ability to instruct; by reviewing our notion of the importance of what we have learned; by assuring ourselves we really are willing to have our juniors learn anything they feel like learning; by convincing ourselves of our proper role as servants--intelligent, even brilliant, knowledgeable, skilled, maybe even wise--"dofers". Our attitude changes can form the social therapy which will reduce fear of learning and restore the inherent motivation for learning.

Is the idea of servant status, of being a "dofer" troublesome? Let's hope not. Some of the worlds most reknowned teachers have emphasized their servant roles. One insisted on washing the feet of the in-group of students, drying them with his hair. That may have been a bit too Hollywood for some of us, but it sure made the point.

Not only our attitudes, but our goals as teachers will require attention if we hope for our students to reach full potential for learning, if we hope to assist in that process, if we hope to

potentiate.

For example, many of us are stuck with the "socratic error." We like to think of Socrates as one of the truly great teachers. We aspire to the socratic method.

Socrates encouraged students to think and to express their thoughts. However, in reading the Dialogues, it soon becomes clear where Socrates is going. He encourages students who express ideas heading in that direction, but he also puts down the others. In this way, students arrive at the conclusion Socrates wants. He has brilliantly led students to think, to express ideas, to learn for themselves everything he knows--a sadly limited goal.

What Socrates knows simply isn't enough. Each generation of students has the potential to reach beyond the known. Our fulfillment as teachers lies in the success of our students in grasping what we have not grasped. When we have served them in that, we have achieved a truly noble goal. If some of them then, having reached beyond us, become teachers with the same noble goals, we shall have defined the sublime.

Hopefully, none of what has been said suggests that teachers ought to abdicate power, If teachers are to influence the direction of events, and we should, power is a necessity.

In typical universities, faculty has exercised power largely through the setting of course requirements and prerequisites, and through evaluation of students. Other forces may sometimes override faculty in establishing curriculum, but very seldom in course requirements or prerequisites, or in the evaluation of students.

These are important functions. In setting course requirements,

the faculty defines for students what they may expect, as a minimum, from the course, and what the School will aver to others that students have, as a minimum, gained from the course. In setting prerequisites for courses, the faculty advises students as to prior learning necessary in order to get their money's worth. In evaluating students, faculty advises as to the wisdom of further study in the area.

To see these as important exercises of power, however, is a serious mistake. On the one hand is the danger of diminishing the power of those who need it. For example, to continue or to dismiss a student on the basis of a grade is to take over some of the responsibility for learning or not learning.

On the other hand is the danger, our attention being deflected by these matters, that matters seriously needing the exercise of our power will suffer. For example, others may take advantage to make decisions, fait accompli, in matters such as relationships with trustees, with the general public or legislature, with the athletics people, and so on.

Finally, though, we have a much more important source of power. It lies in our role as servants, "dofers." Reflect for a moment on our dependance on those who serve us, such as those who supply electrical current, or our servants in medicine, waste disposal, transportation, food distribution, etc. In many respects, we are at the mercy of our servants.

Just so, other aspects of an education system depend upon us, insofar as we are good servants. Trustees are guided in their actions by our knowledge and judgment. The decisions of students are in large measure shaped by our suggestions, our advice, our example. The extent to which one reaches true potential for learning hinges on exposure to quality teachers.

INTEGRATING INFORMATION TECHNOLOGIES INTO LEARNING: THE BENEFITS OF THINKING STRATEGICALLY AND ORGANIZATIONALLY

by

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INTRODUCTION

We are in the midst of a computer revolution on our campuses that is, from all indications, inevitable. However, we must recognize that, while these changes will alter our institutions, the direction of these changes is not precisely known and is indeed subject to significant manipulation. The central proposition of this paper is that we must plan and manage wisely the changes that are emerging from the computer revolution, or we will subject our institutions to serious danger and miss important opportunities for institutional improvement. While the pressures on our institutions are less immediately negative than the campus unrest of the 1960's or the financial stresses of the 1970's (in fact, there are significant opportunities for institutional advancement), a prudent academic leader surely recognizes that institutional developments entailing major shifts of resources pose threats to an institution's finances, competitive position and organizational integrity. Are we prepared to manage this complex, large-scale revolution that is overtaking us? More specifically, are we prepared to manage this revolution so that the academic quality of our colleges and universities is enhanced? How do we assure that more effective and satisfied faculty and more competent and wiser students emerge from this period of change?

The organizational literature suggests that the effective institutional leader exhibits consciousness of internal and external forces, the capacity for strategic choice (determining a distinctive sense of direction) and the ability to organize goals, resources and management approaches.[1] The primary emphasis of this paper is the first aspect; that is, the need to know the institution's context and the forces and elements that shape both strategic and tactical decision-making. Several perspectives will be presented that are

designed to identify important areas of decision and emphasis. Since it is assumed that many observers are actively engaged in assessing the technical implications of the computer revolution (microchip advances, cost reductions, technological capacities, literacy levels, job shifts), the major emphasis here is the internal context and the choices that we face on our own campuses. In addition, the paper will suggest some criteria for making decisions in various contexts and suggest the styles of leadership that best match our present situation.

Computers and Organizational Stress

What are the pressures that presently confront us? While awareness of circumstance and the ability to manage our destiny are crucial to effective leadership, we know that in times of stress and rapid change a leader's capacity to maintain consciousness and control is often reduced. On a daily basis, we saw Nixon's awareness of political reality and his ability to shape events ebb as the Watergate crisis unfolded over the months. During the 1960's, we saw Grayson Kirk at Columbia, Clark Kerr at Berkeley and many other college presidents make self-defeating decisions as they misread the forces around them and lost control of their institutions. In a more limited way, if we look carefully at the colleges with which we are familiar, we see considerable variation in the way they demonstrate consciousness and control.[2] We must be concerned about the consequences for a college or university when, for whatever reason, the institution's leaders lose effective consciousness and control.

An examination of organizational histories indicates that diminished leadership capacity is often coincidental with the following conditions: (1) strong and immediate external pressures, (2) institutional actors who move

aggressively to achieve personal objectives, and (3) triggering events that present situations that are new for leaders and that force decisions that contain a higher risk of alienating segments of the organization.[3] In the face of these factors, leaders often show inflexibility and an inability to envision the future. The mix of a lingering unpopular war, a radicalized student minority and triggering events (such as the Kent State tragedy) presaged the leadership behavior and explosions on college campuses int he 1960's. In a somewhat milder form but no less consequential, many institutions in the 1970's were forced by enrollment shifts, economic pressures and leadership that lived too long by the expansionist mentality of the post-war period to recognize, first, that they had failed to see soon enough what was occurring to their financial position and, second, that they had to accept a loss of control -- for a time, at least -- of their institution's destiny.[4]

The relevance of these organizational dynamics is that, with the computer revolution washing around us, it appears that we are now entering a period in which external pressures are mounting and the demands on leadership are increasing. It is a period of danger, especially since it will be easier to respond in ways that are destabilizing and costly, and of opportunity, since with luck and resources, it will be possible to ride changes to institutional advantage. An important question is whether our institutions and our leaders -- at every level -- are capable of meeting this challenge.

What exactly is the challenge? Drawing on the three aspects mentioned above, the dynamics of change come clearer.

External Pressures -- cheaper computers, addicted users

The advancing computer technologies are producing more powerful, flexible and cheaper hardware and the potential for networking computers. The rate of change is almost unbelievable as enterpreneurial energy world-wide continues unabated. In due course, parents, children, teachers, school administrators, and the mass of citizens will be able to own a

microcomputer. This mass market will eventually overwhelm colleges and universities.

An related aspect is that, as computer companies push their products, universities that move first are able to jump ahead of the market by purchasing computers at bargain prices and outpace adoption rates for the country at large.

Aggressive Actors -- unilateral initiatives by staff, faculty, students
Whether influenced by personal experience with the computer or holding a clear vision of the future, or both, individual members of the college community are acquiring computers, inserting them into their work, pressuring institutional resources and, in effect, moving off in their own direction. While in some cases, a dean or a vice president is dictating these events, the usual circumstance involves decisive action by many individuals at the grass roots of the organization. In addition, as these independent actors become more committed and entrenched, they become vocal political actors pursuing self-interested policy ends.

Triggering Events -- expensive decisions that affect institutional resources and staff
As the consequences of an uncontrolled institutional environment become clearer to leaders, as technological opportunities for creating "institutional" or system-wide solutions grow, and as institutional resources (such as mainframe computers and telephone systems) must be replaced and/or expanded, costly decisions must be made. Any such decision inevitably leads to a degree of resource and political shifting. Some backlash is inevitable. Furthermore, large resource decisions in a time of change are risky and these decisions can go wrong.

The challenge to leaders is to know enough about external and internal forces, and to make decisions that are wise and that sustain control over the destiny of the institution. The first and foremost ingredient of leadership, therefore, is consciousness -- consciousness of the evolving computer technologies, of applications to university activities, of the knowledge, experience and commitment of students and staff, of financial resources available to the institution, of the institution's competitive situation and market for students and funds, of the political situation of the institution, etc.[5] The thesis of this paper is that the more is known by as many institutional actors as possible, the more likely the institution will be able to cope with the dangers and opportunities of the computer revolution. Without this expanding knowledge

base, it will be less likely that consensus will develop for major decisions and that the right strategic moves will be made.

Consciousness of the institution's situation implies comprehensiveness and specificity in the kind of knowledge that is acquired. The following pages present several perspectives suggesting the kinds of information that pertain to integrating computer technologies into the instructional environment.

Strategic Perspectives: Arenas of Analysis and Decision

When one speaks about the role of computers in instruction, one is talking primarily about the role faculty in the academic enterprise. For a moderate-sized comprehensive institution, the units of activity in a typical semester potentially include 700 faculty, 2100 courses and 7500 students. The most basic unit of analysis pertains to Faculty Member A in Course B engaged in Activity C with Student Group D. We must be concerned about the role of computers in each such arena. Are computers used? How are they being used? Has learning been enhanced? What are the costs? What is the overall cost/benefit ratio?

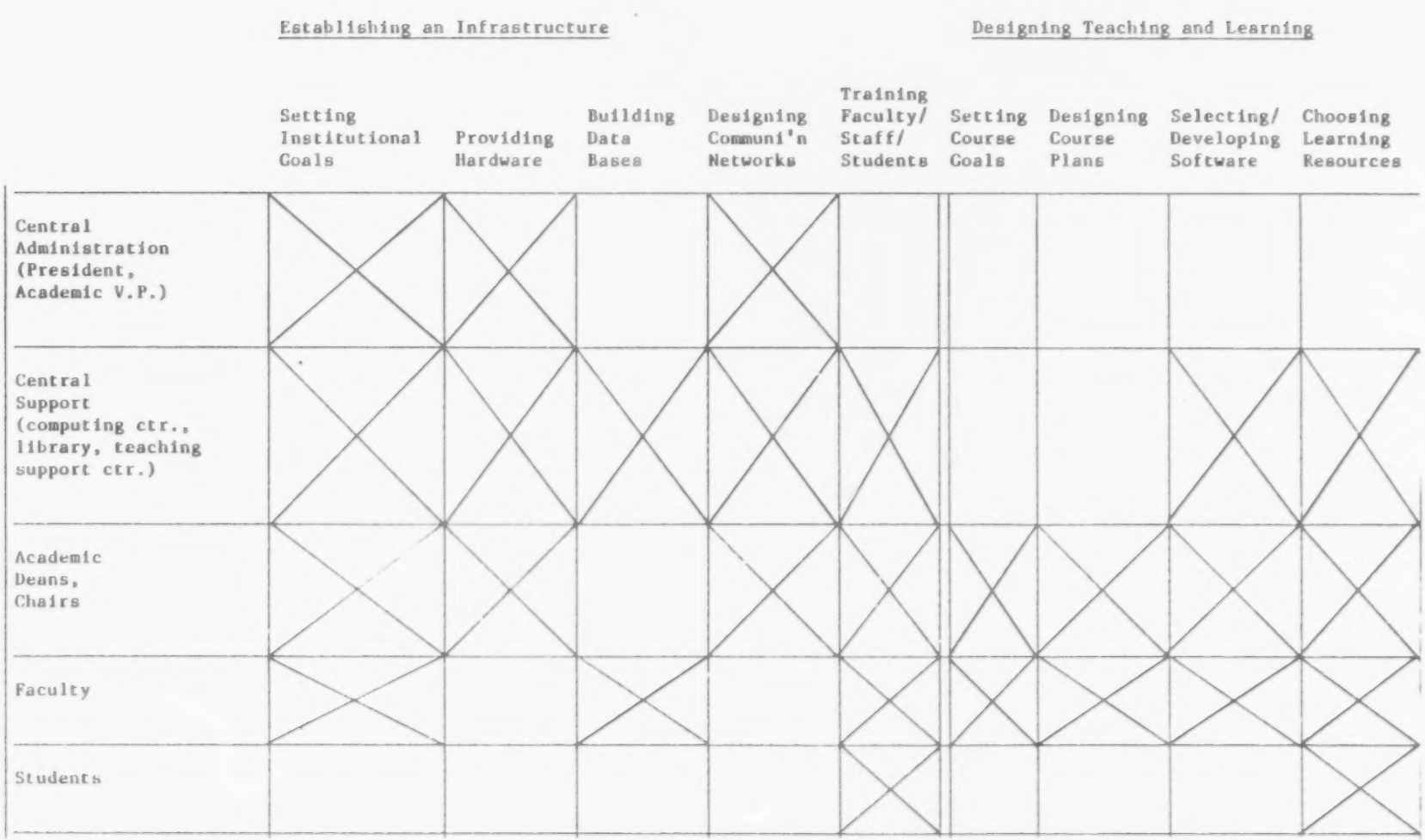
In addition, however, we know that other actors and arenas are inextricably tied to the activities of each classroom. Table A presents the range of computer-related activities and the range of key actors that intersect in the typical institution. Several insights emerge from this picture:

a. Computer development involves both the building of a campus-wide infrastructure as well as the design of learning in each classroom. Needless to point out, the two domains are interrelated and interdependent. However, it is essential to identify precisely where and how central planning and course planning are interdependent.

b. Given the interdependence of various aspects, an important requirement is to determine who should be involved in planning what facets of computer development. Table A includes an "X" at each point where an individual or group has a direct responsibility for making a decision. While from one point of view virtually every box could be marked, the marks seem to represent a minimum coverage of important

TABLE A

DECISION POINTS AFFECTING THE USE OF COMPUTERS IN INSTRUCTION



decisions. The implication of this picture is that in planning, for example, software development, central support personnel, deans and/or chairs and faculty must be involved. Only then will cost issues, resource issues, and pedagogical issues be considered in a unified manner.

c. It is clear that central support offices, academic leaders and faculty are directly involved in virtually every important decision to be made. This suggests that institutions must assure that every support staff person, every dean and chair and every faculty member using or contemplating the use of computers is educated to make good decisions. While faculty training is fairly commonplace, the systematic training of deans, chairs and staff personnel is often a missing element.

d. Insofar as Table A identifies important decision points for the design of learning, we must define the teaching/learning issues imbedded in each decision situation and develop pedagogical and technological criteria for making the wisest choices. Experience suggests that the guiding criteria should include three general areas of focus: pedagogical (What designs promote what kinds of leaning?), technological (What technological choices make the most sense in terms of maximizing effective learning and optimizing effective resource allocation.), and philosophical (What institutional values suggest directions of development and suggest areas that should be limited?). This kind of analysis (actually, a matrix of choices and criteria) can serve as a practical guide to faculty and academic administrators faced with the difficult decisions inherent in the information revolution.

A benefit of this comprehensive perspective is the ability to identify all the actors involved in computer development, the interdependence of these actors and the areas for planning and decision that are sometimes neglected. My review suggests that the most glaring area of neglect on campuses is the design of instruction.

Due to the emphasis in recent years on hardware advances, the activist inclinations of experimenting faculty and the general lack of instructional research, campus discussions have tended to lack specific references to pedagogical issues. While many faculty on our campuses have moved ahead energetically to exploit computer technology in their teaching, there has been little systematic examination of (1) the pedagogical implications of various course

designs and of (2) the actual cost/benefits (human and financial costs/learning benefits) of utilizing computers in teaching.[6] For the benefit of users and non-users of computer technology, we need a sharper picture of the forces impinging on the instructional uses of computers and of the pedagogical choices that we face. At the outset, it is important to recognize that over the next three years large numbers of institutions will attain enhanced capacities for data communications and for linking microcomputers into a campus network. Three interlocking developments are producing this new information environment: first, campuses are implementing campus-wide data communication systems (e.g., the ROLM private branch exchange technology includes both voice and data communications capacities); second, traditional sites providing information for student learning are quickly automating their activities (e.g., the library, registrar, learning support center, career planning and even the classroom); third, microcomputers will expand in quantity and quality, especially as campuses embark on ambitious computer development plans and negotiate very favorable price reductions with vendors.[7] In short, many campuses will soon develop the infrastructure for integrating advanced computer technology into the conduct of teaching and learning, regardless of discipline or field.

The advancing technology presents a host of challenges for those responsible for designing instruction. It is apparent that most faculty and academic administrators do not grasp the implications for pedagogy of a campus-wide communications network that is tied to information repositories and computer stations. Therefore, it is important to analyze how instruction is being altered by these developments. We are well aware of the traditional elements of the campus learning environment and the patterns of communication that have connected these elements. Traditionally, college teaching and learning have

included a student in residence (on or off-campus), a library, academic support sites (such as a learning skills center and a computing center) and the classroom. Students and learning materials move from site to site in accordance with the course plan and the decisions of the students. However, what is emerging is a technological overlay that may fundamentally reform how teaching and learning take place. Table B identifies the electronic network -- the overlay -- that is beginning to tie the campus together in very different ways. This picture assumes the following conditions:

a. More and more students will possess microcomputers and more computers will become available at sites across the campus. Ultimately, every student will have access to a computer whenever he desires with the possibility that every student will actually own a computer. In this eventuality, the residence hall may become the location for as many microcomputers as there are students.

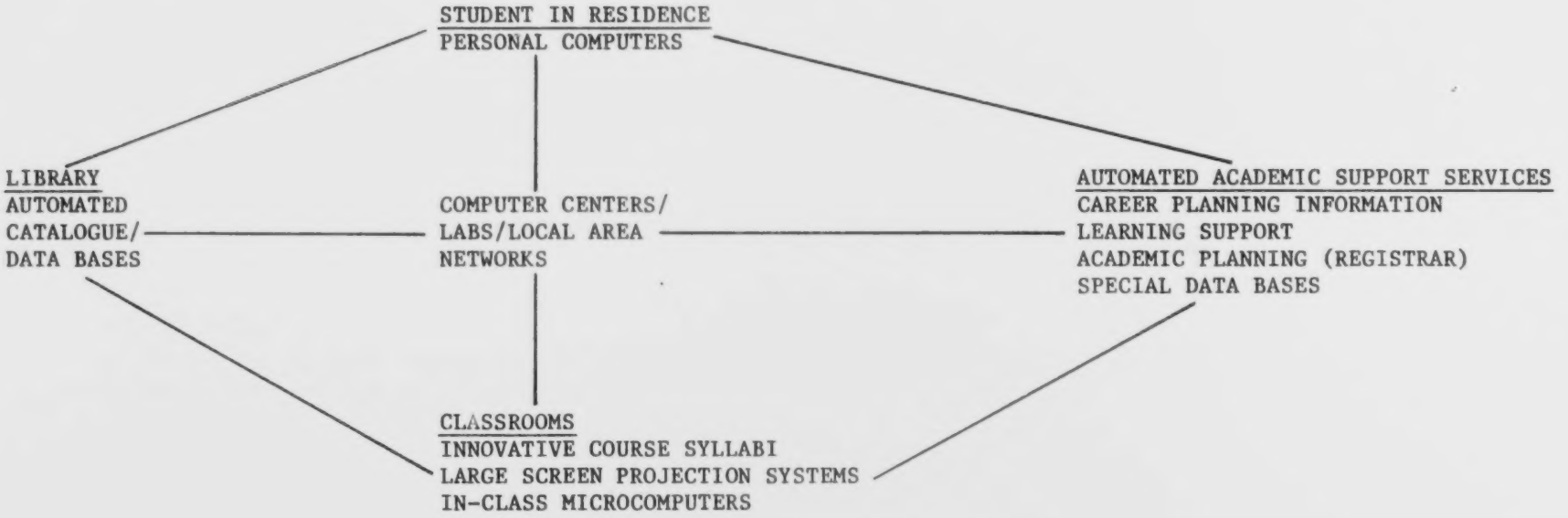
b. The movement to automate libraries will continue unabated and produce automated catalogues, newly accessible data bases on and off-campus and a library staff that is even more involved in the design of classroom learning.

c. Various support offices will automate aspects of their services. We see already that career planning offices, learning remediation programs and registrars are moving in this direction. What administrators in these areas have discovered is that certain kinds of information needed by students can be more efficiently transmitted and manipulated by means of computer technology.

d. The face-to-face interaction between faculty and learners in the classroom will gradually include additional technologies for supporting learning, including the use of microcomputers tied to each other and to mainframes, large screen projectors capable of showing the keyboard and output of a classroom microcomputer and mediated learning packages utilizing film, video/disc, computers and slides. In the short run, the advancing technology and shrinking price of the large screen projectors will be exploited on many campuses.[8] The large screen projector overcomes the problem of how to show to group the output of individualized, miniaturized technologies (i.e., the microcomputer). The limiting factor in upgrading classrooms is the relatively high cost of installing these technologies and the fact that most institutions have not ever budgeted adequately for classroom maintenance and improvement.

TABLE B

THE TECHNOLOGICAL OVERLAY: THE MOVEMENT OF INFORMATION THROUGH AN ELECTRONIC NETWORK



e. Finally, it is becoming possible and efficient to connect the various elements of this campus map. The ROLM private branch enchange technology permits the tying together of computers across the campus, whether in the dormitory, the library, an educational support office or the classroom. The implications for learning of this capacity will be discussed below.

While the present elements in this picture probably do not exist on many single campus, it is safe to assert that most campuses are moving in this direction. If this is indeed the case, it is useful to examine what campuses are doing already.

First, we know that hundreds of faculty -- perhaps thousands -- across the country have designed courses that utilize computer technology. With access to microcomputers or terminals and a mainframe, faculty have adopted or developed programs of considerable variety. Most applications have clustered around the following: high level analytical programs for the physical sciences and mathematics, packaged research programs for the social and natural sciences, non-technical programming in various languages for a variety of disciplines, packaged programs that teach an entire course (e.g. Plato), and various easy-to-use programs for word processing, accounting and data base management.[9] Assisted by computers, students have learned facts, solved problems, participated in simulations, done writing, build models, visualized new concepts and taken tests. Despite the multitude of experiments by faculty on campuses across the country, it is evident that existing faculty applications do not necessarily meet the needs or desires of any other faculty member. It is part of the academic ethic that every course has its unique set of goals and every faculty member has unique strategies and styles. Whether this belief system makes sense or not, we must recognize that little that has come before is directly useful to late arrivals to computer-aided instruction. If a faculty member is to "own" his course, he must build it himself.

A related issue concerns the fact that, despite many excellent precedents in the application of computers to teaching, available software remains limited in quantity, quality and variety. This explains why schools such as Carnegie-Mellon, through the Interuniversity Consortium on Educational Computing, and M.I.T., through its generously-funded Project Athena, are embarked on ambitious efforts to develop software of use to a variety of higher education institutions.[10] In the meantime, however, it is useful to make the assumption that, due to the stubborn independence of college faculty and the lack of immediately useable software, the development of computer uses will be accomplished mainly close to home, by our faculty, with the help of their colleagues. As inefficient as this route may seem (i.e., every faculty member inventing or reinventing his course), there are several important pedagogical benefits, including the following: the logic of the course remains the logic of the professor of that course; the faculty member carries an emotional commitment to the course by virtue of having constructed it; the faculty member must confront the inherent problems and contradictions of the course and take responsibility for successes and failures; and the faculty member retains the moral obligation to design learning that is responsive to his particular group of learners.

The development of courseware by faculty and by other groups is moving forward in sporadic fashion. Some campuses are making a comprehensive effort; most campuses exhibit small pockets of energetic activity and accomplishment. This pattern of sporadic progress is evident in the elements displayed in Table B -- a very few campuses are moving systematically on all fronts; most campuses are making some progress in one or more areas. All of this suggests it will be a considerable time before fully-developed capacities in software, hardware, library automation, classroom technology and faculty and student readiness

converge in any one setting. There is a danger that one sector of the campus will move ahead and drive, sometimes unwisely, decisions in other sectors. For example, whereas requiring microcomputers for incoming students in engineering may make sense, this may make no sense -- at least, for the next several years -- for students in the liberal arts. The task becomes that of moving ahead in such a way that the needs of each academic area and of each faculty member are accommodated. While a dose of competitive tension can be productive, it is important that computer development proceed from a realistic understanding of each area's readiness and from a case-by-case calculation of likely costs and benefits.

In looking at the range of actors and activities affecting instruction (Table A) and the elements of the emerging technological overlay (Table B), certain observations and principles have come clear. First, campus-wide decisions and course-specific decisions must be perceived as interrelated and interdependent. Second, implications for designing teaching and learning must be examined at each decision point, with reference not only to resource issues but also to expected or demonstrated benefits to learning. Third, we need to recognize that the primary agent for instructional change will remain the faculty member, and we must organize accordingly. Fourth, we must sustain a comprehensive view when planning computer developments so that change on campus can occur in a manner that is reasonably coherent and unified. Finally, if one grants that the overlay described in Table B represents the direction that the instructional world is moving, it is useful to imagine the likely long-term impact on the way teaching and learning will take place. One writer drew the following scenario:

> Students working in a computer-intensive environment will have opportunities significantly different from those of today. Sitting at desks in

> dormitory rooms, they will be able to use machines with analytic, computational, and design capabilities comparable to the best of those now available to working engineers. They will have access to extensive information services and data banks. They will be able to interact through the computer with other students and faculty and potentially with other individuals with similar interests anywhere in the world. And they will be able to use simulation and modeling software that constitutes a fundamentally new information resource."[11]

This quotation represents one view of the future. It may be incomplete; it may be overly optimistic; it may not be something we want. However, the point is that, unless we engage in similar futuristic thinking, we will fail to anticipate important possibilities and pitfalls. In short, we should recognize that we don't actually know much about the likely effects of computer technology on instruction and on our institutions and, as such, we should try to discern what changes are inevitable and what elements are amenable to our influence.

The Computer Revolution as an Organizational and Management Problem

While this paper has suggested several specific problems that must be addressed, it is beyond the scope of this paper (and perhaps any observer) to suggest "solutions" to these problems. The world is too complex, diverse and changing to attempt such an undertaking. In addition, it is certain that any accepted wisdom will be conditioned greatly by the special circumstances of each campus. Thus, the problem we face today is less the finding of solutions to specific computer questions -- we will reach answers but these answers will have a short shelf life -- than it is thinking wisely and effectively about how to approach the issue of computers. Thinking organizationally, what are the comprehensive pictures we need to carry in our heads and by what strategies do we manage the affairs of the institution? Having identified above two important pictures (Tables A and B), the focus of this section is on the right way to think about managing the computer revolution. Who should make what

kinds of decisions? What kind of an organizational environment should we encourage?

The contemporary academic institution, especially the comprehensive university, is a diverse, horizontally-structured, loosely-coupled enterprise.[12] While an organizational chart might suggest that the president, academic vice president or dean is in a position to mandate activities, the actual decision process works quite differently. Except in a few selected areas, faculty have considerable control of their lives and are in a position to effectively veto almost any academic initiative that they do not like. Top level leaders may articulate a strategic direction but chairs and faculty must internalize the goal and its rationale before one can expect committed effort. Thus, on the rare occasions when a formal decision is made, the decision-making tends to be slow and consensual. Also, it is useful to recognize that many important shifts in direction occur, not by formal decision of the institution, but by the accumulated decisions of individual chairs and faulty. Frequently, decisions serve primarily to codify or marginally reshape patterns of behavior that already exist in the enterprise.

In this loosely-coupled enterprise, the decisions that shape the introduction of computers to a campus involve actors at the top-level and at the grass roots of the faculty. Presidents and trustees decide what mainframes to buy, what microcomputer vendor with whom to contract and whether to invest in library automation. Chairs and faculty decide whether and how to redesign a course, what software to use and how student learning will be evaluated. Despite the relative autonomy of presidents and faculty in making decisions in their special arenas, it is clear from the previous discussion that many important decisions are of direct interest to more than one constituency. Thus, an

important organizational question concerns how to identify the right decision-makers on a particular issue and how to bring them together.

Another characteristic of the modern college or university is the prevalence of professional expertise. Staff members of the computer center, a few academic administrators, computer scientists and a handful of faculty in other disciplines are experts in various aspects of computers. Every faculty member is an expert in the discipline for which he was trained and conducts teaching. Each of these experts has a instinctive resistance to intrusions that affect his area of expertise. As a result, it is often difficult to get faculty and staff to benefit from each other's knowledge. However, we know that computer knowledge and knowledge of the discipline are both essential to planning a course that employs computer technology. A related problem is that many of the decisions pertaining to computer development have more to do with resource allocation, budget planning, the setting of priorities and educational policy than with computers per se. J. Victor Baldridge and his colleagues have described this issue:

> We have watched too many forceful administrators suddenly become intimidated when confronted with large-scale computer decisions. A baseline idea needs to be established. They key policymakers, even though nontechnical, are nevertheless experts about the decision arena. Fundamentally that is what we confront here: a decision arena focused on computers.[13]

Baldridge goes on to emphasize both the important role of non-experts in decision-making about computers and the essential contribution of computer experts who bring critical knowledge, experience and judgment. The overall management task is to bring all knowledgeable individuals -- computer experts, subject matter specialists, and key administrators -- into planning and decision-making.

The fragmented structure of the university, the interdependence of various constituencies concerned with computers, the rate of change in the computing world and the importance of the decisions to be made present a difficult management challenge. However, there is a convenient match between these conditions and the management approaches recommended by several contemporary management theorists. Twelve years ago Harlan Cleveland anticipated the management needs of the today's organization:

> The organizations that get things done will no longer be hierarchical pyramids with most of the real control at the top. They will be systems -- interlaced webs of tension in which control is loose, power diffused, and centers of decision plural. "Decision-making" will become an increasingly intricate process of multilateral brokerage both inside and outside the organization which thinks it has the responsibility for making, or at least announcing, the decision. Because organizations will be more horizontal, the way they are governed is likely to be more collegial, consensual, and consultative. The bigger the problems to be tackled, the more real power is diffused and the larger the number of persons who can exercise it -- if they work at it.[14]

Whether by choice or chance, it is clear that decisions about computers on many campuses are being handled in a manner suggested by Cleveland. While major resource decisions rest ultimately at the top, numerous individuals and units have a role in shaping decisions. An important question concerns whether this diffuse situation leads to clear choices that are in the best interest of the institution. This is a matter of leadership. Cleveland writes about the need to create "constructive ambiguity" and about the role of leaders in catalyzing consensus and decision.[15] However, more recent writers have improved upon this picture of the leadership function.

Writers such as Galbraith, Peters and Waterman, and Naisbitt call for the conscious design of the organizational environment, positive-thinking leaders who induce commitments to targeted projects and tasks, the building of coalitions and networks of individuals cutting across organizational lines (but

relevant to the task at hand), and the development of human resources as the essence of organizational strength.[16] The computer challenge constitutes an ideal circumstance for trying these management techniques in higher education. Indeed, the computer issue represents our best opportunity in many years to undertake as an institution a program of change that is essentially positive and that may serve to unify the various constituencies of the institution. After several years of economic retrenchment, recurrent conflict between faculty and administration and an expressed sense of powerlessness on the part of many, we may be able to move our institutions back onto an agenda that is academic in nature and enhances the self-esteem of those involved.

In sum, our ability to meet the computer challenge depends on our ability to think wisely about the task and to induce effective leadership at every level of the institution. The evidence suggests that we now know enough about computing developments, about instructional requirements, about our institutions and about leadership to carry it off. If we do succeed, we will have overcome the worst fears of many by bringing computers to serve us by addressing our most critical human, educational and organizational needs. From this perspective, the opportunities clearly outweigh the obvious inherent dangers, and this is sufficient grounds for serious, institution-wide planning and commitment.

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2. Some examples of this variation appear in Chaffee, Ellen E., Case Studies in College Strategy, NCHEMS: Boulder, Colo., 1983.

3. These forces are described in the Report of the President's Commission on Campus Unrest, published as special issue of College and University Report, Number 277, September 29, 1970.

4. See Mingle, John and Associates, Challenges of Retrenchment, Jossey-Bass: San Francisco, 1981.

5. Galbraith, Op. Cit.

6. See Ploch, Margie, "Micros Flood Campuses," High Technology, March 1984, pp. 47-49 and Friedman, Edward, "The Wired University," IEE Spectrum, November, 1984, page 120.

7. An excellent overview appears in Friedman, Op. Cit.

8. Sony now sells a high quality large screen video projection system for about $5,300. The unit may be permanently installed (at a higher price) or used as a mobile resource for classrooms across the campus.

9. This listing is contained in Baldridge, J. Victor, Roberts, Janine and Weiner, Terri, The Campus and the Microcomputer Revolution, MacMillan: New York, 1984, page 112.

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12. See, for example, Weick, Karl, "Educational Institutions as Loosely Coupled Systems," Administrative Science Quarterly, Vol. 21, Issue 1, March 1976, pp. 1-19.

13. Baldridge, Op. Cit., Preface.

14. Cleveland, Harland, The Future Executive, Harper and Row: New York, 1972 page 13.

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16. See Galbraith, Op. Cit.; Peters, Thomas and Waterman, Robert, In Search of Excellence, Harper and Row: New York, 1982; Naisbitt, John, "Reinventing the American Corporation," The New York Times, December 23, 1984.

HANDS-ON PROGRAM OF IBM-PC TRAINING AT LOS ALAMOS NATIONAL LABORATORY

by

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Abstract:

Since December, 1983, the Laboratory has offered introductory courses of IBM-PC training. A comprehensive needs assessment was conducted and a nine-course module of classes was designed and implemented. Forty classes were completed in the one-year period.

The target group includes the novice computer user in the scientific, management, administrative, and secretarial personnel groups.

The development, needs assessment, course implementation and design, course evaluations, and future direction of computer training will be discuessed.

Lab-automation, robotics, design of the lab and office and the impact of computer on society will be discussed briefly.

INTRODUCTION:

The PA-15 Training Office at the Los Alamos National Laboratory has as a part of its mission to develop human resources and enhance scientific excellence through various training programs.

During the past year approximately 900 IBM personal computers were purchased for use as personal workstations for laboratory employees. The Training Office received numerous requests for IBM-PC training and thus began the course developmental procedure to assess needs, design a module of courses, and implement and evaluate the courses. This process resulted in a nine-course module of forty instructor/hands-on instructional courses conducted from December 1983 through December 1984 for over 400 employees. The target for these courses was the novice computer user among the scientific, management, administrative and secretarial employee groups.

The following discussion will address these topics and briefly discuss the impact of the computer on society, design of laboratory and secretarial, and scientific office and laboratory automation.

COURSE DEVELOPMENT:

The development of courses at the Training Office uses the Instructional Systems Development procedures as shown in Figure 1. The development of the IBM-PC courses included a pilot course, a needs assessment, the course design, and implementation and evaluation of the courses.

Pilot Course: In December 1983 a pilot course in the Introduction to the IBM-PC was offered in the Los Alamos Training Office due to requests from personnel.

Purpose: The course was designed to teach the participant the fundamental concepts and terminology of the microcomputer field; the basic operations involved in day to day computer use (saving, retrieving, and copying files); the basic functions involved in operating a computer; minor troubleshooting of a computer system at an operator level; and an introduction to the use of applications programs such as word processing, data base management, and electronic spreadsheets.

The participants in the course had the opportunity to practice during the class hours under the supervision of the instructor. The course included several HANDS-ON ACTIVITIES to insure that each participant left with the ability to operate and use the IBM-PC in an independent manner.

Course participants will

- Have an understanding of the terms and the fundamental concepts of microcomputers.
- Be able to operate the IBM-PC and associated equipment such as disc drives, printers, and video monitors without assistance.
- Use the IBM-PC operating system to perform the basic functions of formatting discs, copying files, copying discs, and saving and retrieving files.- Use application programs such as word processing, data base management programs, and electronic spreadsheet programs.

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Instructional Systems Development: Steps and Outcomes

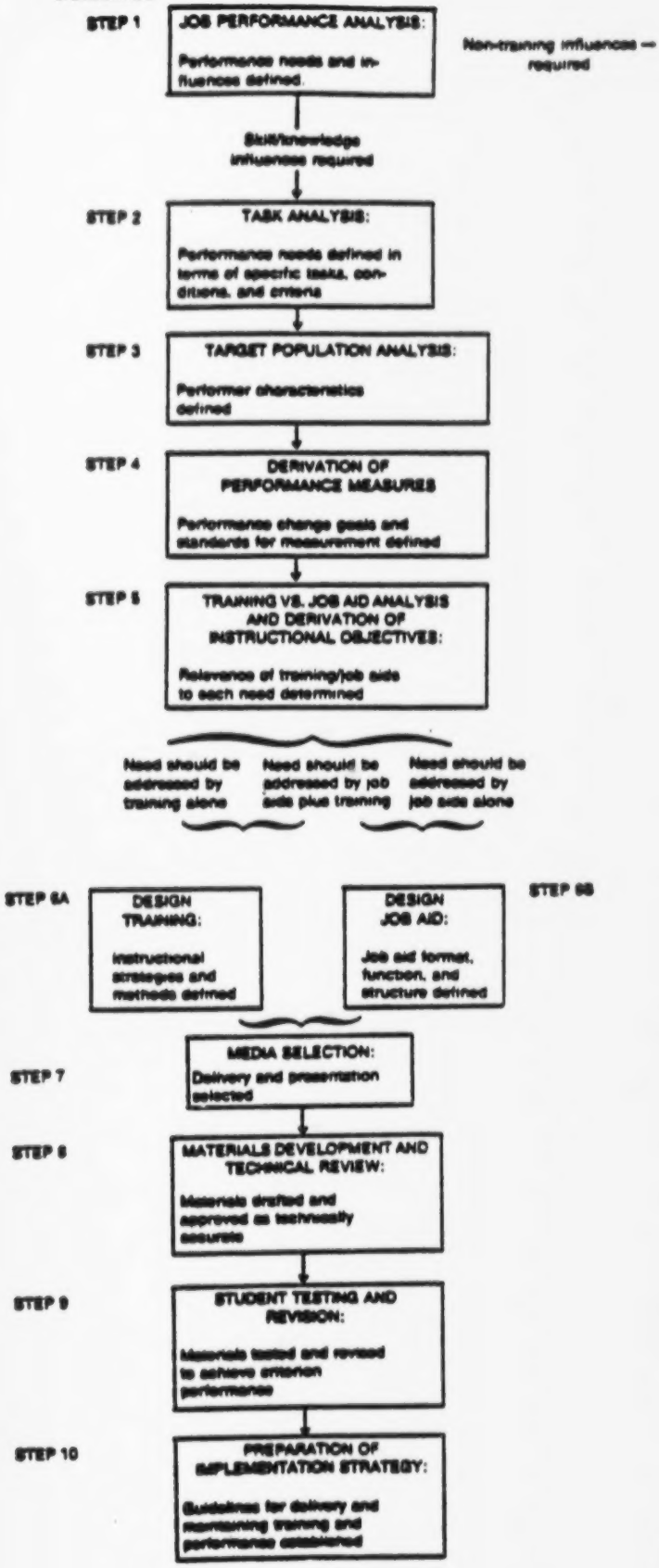
STEP 1
JOB PERFORMANCE ANALYSIS:
Performance needs and influences defined.
Non-training influences — required
Skill/knowledge influences required
STEP 2
TASK ANALYSIS:
Performance needs defined in terms of specific tasks, conditions, and criteria
STEP 3
TARGET POPULATION ANALYSIS:
Performer characteristics defined
STEP 4
DERIVATION OF PERFORMANCE MEASURES
Performance change goals and standards for measurement defined
STEP 5
TRAINING VS. JOB AID ANALYSIS AND DERIVATION OF INSTRUCTIONAL OBJECTIVES:
Relevance of training/job aids to each need determined
Need should be addressed by training alone
Need should be addressed by job aids plus training
Need should be addressed by job aids alone
STEP 6A
DESIGN TRAINING:
Instructional strategies and methods defined
DESIGN JOB AID:
Job aid format, function, and structure defined
STEP 6B
STEP 7
MEDIA SELECTION:
Delivery and presentation selected
STEP 8
MATERIALS DEVELOPMENT AND TECHNICAL REVIEW:
Materials drafted and approved as technically accurate
STEP 9
STUDENT TESTING AND REVISION:
Materials tested and revised to achieve criterion performance
STEP 10
PREPARATION OF IMPLEMENTATION STRATEGY:
Guidelines for delivery and maintaining training and performance established

Figure 1

- Read, understand, and make use of computer reference manuals.
- Recognize how microcomputers can be used in the office to increase both efficiency and productivity.
- Assemble and disassemble the computer hardware system and diagnose minor hardware and software problems.

The twenty-hour course was offered in two, half-day, five-day sessions, (morning 8 a.m. - noon or afternoon 1 p.m. - 5 p.m.) for a total of twenty-four employees. The class format was lecture/discussion and demonstration using video projection from the instructor's computer to two video screens in the room. Hands-on lab sessions were dispersed between the lecture/discussion sessions. Students were introduced to the use of the application programs of Wordstar word processing, VisiCalc electronic spreadsheets, Lotus 1,2,3, and PFS database management. The use of computer reference manuals, basic functions involved in operating a computer and fundamental concepts and terminology of the microcomputer field were discussed. The room consisted of six 30" x 60" tables with six IBM-PC's and 6 Epson RX-80 printers for a class of twelve students. The instructor met the requirements of educator and computer scientist with a college teaching background in computer science and math. He was familiar with Los Alamos National Laboratory as a former employee in the computing division. The instructor prepared a manual to accompany the lectures and provide hands-on activities.

Student evaluations of the pilot course were most favorable with the hands-on format, the friendly, unpressured atmosphere created by the instructor, and the individualized instruction available during the lab sessions. Overall evaluation of the course was very favorable but it was evident that a needs assessment of the future IBM-PC training requirements of over 900 Laboratory PC users needed to be

completed before the course could be redesigned to meet personnel needs.

NEEDS ASSESSMENT

An assessment instrument (Figure 2) was design and distributed to various Laboratory groups using the IBM-PC. Results of the assessment were compiled from 99 completed and returned questionnaires. The computer use level of resondents was equally distributed between "very often", "often" and "sometimes". (Many employees have been using various mainframe computer systems throughout the Laboratory from Hewlett Packard, IBM, VAX, Cray but had no experience on microcomputers.) The level of operation and application understanding varied but most were in the "fair" category. Live instruction was preferred over videotape instruction. Half of the respondents indicated a need for immediate instruction and the remaining forty percent within 6 months, and ten percent within the year.

An important need was indicated by the assessment. The greatest need of respondents was for an introduction to the IBM-PC course followed by wordprocessing (Multimate). The second need was for an electronic spreadsheet (Lotus 1,2,3 preferred). The third need was for a database management course (Lotus 1,2,3 followed by PFS:File and DBASE II). The programming language courses most wanted were beginning and advanced BASIC and Pascal. Other courses suggested included: UNIX, "C" assembly language, MAPPER, INFORM, DOS, graphics, interfacing with the CCF (central computer facility), data transmissions (logging and autotype), hardware concepts (RAM, ROM, serial ports, Raster graphics, hard disks), interfacing peripheral hardware (plotters, digitizers), general information on IBM-PC software available, introduction of IBM-PC applications, night classes, and "live" advanced courses. This information was used to develop the nine-course module of Introduction to the IBM-PC classes.

IBM-PC TRAINING NEEDS ASSESSMENT

Los Alamos National Laboratory recently purchased a large number of IBM PC microcomputers for use by lab employees. More IBM-PC microcomputers are expected in the near future. The Training Office (PA-15) and C-10 are determining the training needs of all employees who use these microcomputers. Please give as much information as possible to help us provide the best training possible for Laboratory employees.

---

1. Rate your own level of computer use. (Circle one)
   VERY OFTEN OFTEN SOMETIMES INFREQUENTLY NEVER

2. Rate your level of understanding the operation and application of microcomputers. (Circle one)
   EXCELLENT GOOD FAIR LITTLE NONE

3. Listed below are courses dealing with application of the IBM-PC microcomputers. Rate your need for each course on a scale of 1 to 5 (1 = no need, 5 = very needed).

	Your need	Needs of co-workers	Number of co-workers
Introduction to the IBM-PC	____	____	____
Word Processing	____	____	____
Multimate	____	____	____
Wordstar	____	____	____
Easywriter	____	____	____
Other (specify)	____	____	____
Electronic Spreadsheet	____	____	____
Multiplan	____	____	____
Visicalc	____	____	____
Supercalc	____	____	____
Lotus 1-2-3	____	____	____
Other (specify)	____	____	____
Data Communications	____	____	____
Data Base Management	____	____	____
dBase II	____	____	____
Pfs:FILE	____	____	____
Datastar	____	____	____
Lotus 1-2-3	____	____	____
Other (specify)	____	____	____
Programming Languages	____	____	____
Beginning BASIC	____	____	____
Advanced BASIC	____	____	____
Pascal	____	____	____
Fortran	____	____	____
Cobol	____	____	____
Other (specify)	____	____	____

Other Courses:
1. _____
2. _____

(use other side if necessary)

Would you prefer a live-course or self-study course? (Circle one) If self-study: CAI or videotape? (Circle one) Do you need instruction immediately or in future? (Circle one)
How critical are your instructional needs? (i.e. need now, 6 mo., 1 year) (Circle one)

Figure 2

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COURSE DESIGN:

Using information from the pilot course and the needs assessment summary, aspects of the course were re-evaluated and modifications for the new courses were considered. The use of video monitors to be daisy-chained from the instructor's computer to the student computer instead of the video projection of the instructor's screen and keyboard was reconsidered due to the poor resolution of the video projection onto TV screens. The pilot course contained students who were fearful and intimidated by computers. Some looked upon computers as monsters or as a necessary evil with which to deal. Therefore the class format was carefully considered, to produce a non-threatening, reassuring, supportive classroom atmosphere which would create the most productive learning environment for this type of student. It was suggested that the first few minutes be a friendly, get-acquainted, relax-with-a-cup-of-coffee time with the instructor. This was followed by a forty-minute lecture/discussion alternated with the hands-on lab sessions. Students were to be paired by their own choice to stimulate the learning process. Multimate replaced VisiCalc for more job relevance. The Introduction to the IBM-PC: Overview course materials were designed for the novice microcomputer user to meet the goals stated in the pilot program.

COURSE IMPLEMENTATION:

Course dates were set, rooms reserved, purchase requests for the instructional vendor and approvals completed. Courses were advertised in the Laboratory NewsBulletin, course flyers were distributed lab-wide and enrollments registered by the PA-15 secretarial support staff. Courses designed included the following: -

Introduction to the IBM-PC: Overview (20 hours)
Fundamental concepts of microcomputers, basic operating functions, introduction to application programs and use of computer manuals. Hands on activities. Recommended as first course for the non-user.

Introduction to the IBM-PC: Lotus 1,2,3 (16 hours)
Use electronic spreadsheets to solve problems of budget, project and personnel management; create and search data bases and graph data using pie, bar, and line graphs; hands-on activities.

Introduction to the IBM-PC: Multimate (16 hours)
Create and format short and long documents; use basic editing features of Multimate; use formatting features (change print sizes, bold printing, underlining, centering, decimal tabs, footers, headers, and pagination); create scientific documents (special symbols); create primary and secondary documents; merge and create repeating merged documents; copy and move text in documents; perform column addition; create libraries; and print documents; hands-on activities and assignments.

Introduction to the IBM-PC: dBase II (20 hours)
Introductory course in the design, creation and use of data bases; access, sort and modify data bases; produce reports using BASIC programming; no programming experience necessary; hands-on activities.

Introduction to the IBM-PC: Beginning BASIC Programming (20 hours)
Fundamental concepts of programming languages; write programs using input and output statements, branching statements, iterative statements, single and double subscripted variables, subroutines; error handling, string handling, random-access disk files, sorting and searching data files, and elementary graphics; participants will develop a data base management program as part of the course; hands-on activities.

Introduction to the IBM-PC: Advanced BASIC Programming (20 hours)
Advanced error and string handling, sorting techniques (Shell and Q-Sort), binary search, linked-list data structures, and graphing techniques; students will develop a data base program with a form generator, editor, sorting and searching several fields, numeric and non-numeric sorts and searches of data base; formatting and printing of records; graphing data; hands-on activities.

Introduction to the IBM-PC: Graphics (20 hours)
Introduction to graphics concepts; develop statistical packages to produce bar graphs, pie charts, and line graphs; hands-on activities.

Introduction to the IBM-PC: DOS 2.0/2.1 (8 hours)
Basic concepts of operating systems; format and copy disks; create directories necessary for use of IBM-XT; copy, rename, delete, sort and print files; hands-on activities.

Introduction to the IBM-PC: WordStar (16 hours)
Create, modify and produce letters and reports using Wordstar software. Hands-on activities.

DEGREE LEVEL: Table A. Percent of Students

	Over view	Lotus 1,2,3	Multi mate	dBSE II	DOS 2.0/2.1	Beg. BAS. P.	Adv. BAS.P	Avg % Total	% of Total
PhD	8.7	6.1	5.4	2.9	7.1	11.8	25.0	7.0	
MS MA	13.0	9.8	2.7	17.7	7.1	5.9	-	9.4	
BS BA	23.8	26.8	21.6	32.4	28.8	35.3	25.0	28.1	
AS AA	9.2	11.0	5.4	8.8	25.0	11.8	25.0	11.9	
none	42.2	29.3	54.1	35.3	21.4	35.3	25.0	36.3	
not known	3.2	2.4	10.8	2.9	10.7	-	-	5.0	

Table B. Number of Students

PhD	22	5	2	1	2	2	2	36	9
MS MA	28	8	1	6	2	1	-	46	11
BS BA	48	22	8	11	8	6	2	105	26
AS AA	17	9	2	3	7	2	2	42	10
none	88	24	20	12	6	6	2	158	39
not	6	2	4	1	3	-	-	16	5
TOTAL								403	100

Figure 3

JOB TITLE: Table A. Percent Students

	Over view	Lotus 1,2,3	Multi mate	dBSE II	DOS 2.0/2.1	Beg. BAS. P.	Adv. BAS.P	Avg % Total	% of Total
GEN	23.8	20.7	35.1	20.6	21.4	5.9	-	21.3	
TECH	21.6	13.4	18.9	26.5	39.3	29.4	50.0	24.9	
ASM	24.3	29.3	18.9	8.8	7.1	17.7	50	17.7	
SM	22.7	20.7	24.3	35.3	28.6	41.2	-	28.8	
MS	4.3	-	2.7	5.9	3.6	-	-	2.8	

Table B. Number of Students

GEN	44	17	13	7	6	1	-	88	23.8
TECH	40	11	7	9	11	5	4	87	23.5
ASM	45	24	7	3	2	3	-	84	22.7
SM	42	17	9	12	8	7	4	99	26.7
MS	8	-	1	2	1	-	-	12	3.2
TOTAL								370	100.0

Figure 4

SUPERVISORY RESPONSIBILITY:

Table A: Percent of students

	Over view	Lotus 1,2,3	Multi mate	dBSE II	DOS 2.0/2.1	Beg. BAS. P.	Adv. BAS.P	Avg % Total	% of Total
YES	35.7	28.1	21.6	23.5	25.0	17.7	25.0	25.3	
NO	55.7	54.9	64.9	70.6	67.9	58.8	75.0	62.1	

Table B: Number of students

YES	66	23	8	8	7	3	2	117
NO	103	45	24	24	19	10	6	231
TOTAL								348

Figure 5

Course Data

	Over view	Lotus 1,2,3	Multi mate	dBSE II	DOS 2.0/2.1	Beg. BAS. P.	Adv. BAS.P	TOTAL
Total Number taking class	209	82	37	34	28	17	8	415
Number of Classes	18	8	4	4	3	2	1	40
Average number/ class	12	10	9	8.5	9	8.5	8	10

Figure 6

SUMMARY OF COURSE DATA:

Tables of student data and class statistics are compiled in Figures 3 - 6.

Degree Level:

In Overview and Multimate, there were close to twice as many students without degrees as with BS/BA degrees, the next highest category. In Beginning BASIC Programming, the BS/BA and the "none" categories both had 35%, about three times as many people as in the next highest categories, AS/AA and PhD. In Lotus 1,2,3 and dBASE II, the largest category, students without degrees, was only slightly larger than the next largest category, students with BS/BA degrees. This category was only slightly larger than the AS/AA category. The BS/BA category was 8% smaller than the largest category. Excluding the "unknown" category, the smallest categories were PhD and MS/MA in all the courses.

Job Title:

The Overview course was the only course that showed a fairly even distribution across the various categories (excluding the MS category, which was 4%, or 8 people). In the other courses, except for the Advanced BASIC Programming course, one category came out approximately 10 percentage points higher than the next highest category. In the Lotus 1,2,3 course, ASM was the highest and Gen and SM were approximately 10 percentage points lower. In the Multimate course, the Gen category was the highest and SM was the second highest. In dBASE II, SM was the highest category. The ASM category was significantly smaller than the Gen and Tech categories. The Tech category was the highest in the DOS 2.0/2.1 course. Again, the ASM category was much smaller than the other categories (excluding the MS category). In Beginning BASIC Programming, the SM category was very small. Overall, the SM category was the largest, although it was only 4 percentage points larger than the Tech category and 7 percentage points larger than the Gen category.

Out of 370 responses, only 12 were MS's. Eight out of these 12 were in the Overview course.

Supervisory Responsibility:

Over half the people in every course were without supervisory responsibility. The Overview course had the largest percentage of people with supervisory responsibility. The Beginning BASIC Programming course had the smallest.

Course Data:

Classes in Overview and Lotus 1,2,3 were offered every month, Multimate and PC:DOS 2.0/2.1 every two months, Beginning BASIC Programming twice (four month interval) and Advanced BASIC Programming once.

The Overview course had both the largest number of classes (18) and the largest average class size (12). There were half as many Lotus classes as Overview classes, but the average class size was only slightly smaller. The Advanced BASIC Programming class had the smallest average class size. Two Wordstar classes were cancelled due to insufficient enrollment. One Graphics class was cancelled due to lack of hardware and an incomplete manual.

COURSE EVALUATION:

An evaluation was given to each student at the end of the class, and a summary of comments was made and sent to the instructor. Discussions with the instructor after each class resulted in upgrading the next course. It was felt that immediate student feedback was instrumental in developing the modules of classes to the benefit of all. The following is a summary of the majority of comments for each class.

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SUMMARY OF COMMENTS: OVERVIEW

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

- to set up files
- to create memos, charts, reports, etc.
- will apply basic knowledge to existing systems
- to know how to use software
- Lotus 1,2,3 will be used for spreadsheets, budget work, payroll
- data base management
- word processing

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

- hands-on experience
- relaxed atmosphere
- student-teacher interaction
- instructor's manner and presentation
- learning about several different progras

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

- the course should follow the manual more closely
- too much info in too little time

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

- two 8-hour and one 4-hour sessions
- a course for true beginners
- info on other software packages that are available
- make the course longer
- send out handouts and literature before the course starts

5. ARE THERE ANY OTHER COURSES YOU WOULD LIKE TO SEE OFFERED?

- an advanced IBM-PC course
- BASIC programming
- graphics

SUMMARY OF COMMENTS: LOTUS 1,2,3

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

- data base management
- spread sheets
- to create reports, graphs
- to prepare budget
- to prepare Fore B

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

- hands-on training
- the helpfulness of the instructor

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

- the classes were too long
- introductory material
- course not long enough

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

- have half-day, rather than full-day, sessions
- a prerequisite so don't have to go over introductory material
- be able to do graphics

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SUMMARY OF COMMENTS: MULTIMATE

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

   - to create and store letters, memos, and documents
   - to create data files

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

   - hands-on experience
   - the instructor's attitude and instruction
   - the relaxed, informal atmosphere

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

   - not enough time for hands-on experience

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

   - half day, rather than full day, sessions
   - a table of contents and index in the manual
   - make the course a day longer
   - course outline

SUMMARY OF COMMENTS: dBASE II

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

   - to create and maintain data bases
   - to create inventory, stock, and personnel records

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

   - hands-on experience
   - programming
   - the relaxed atmosphere of the class
   - the availability and manner of the instructor

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

   - too little time

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

   - make the course longer
   - have beginning and advanced courses rather than just one course level--have a prerequisite
   - improve the manual

5. ARE THERE ANY OTHER COURSES YOU WOULD LIKE TO SEE OFFERED?

   - advanced dBase II
   - Savvy

SUMMARY OF COMMENTS: DOS 2.0/2.1

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

   - will use with the IBM-PC
   - to create reports and records
   - to distinguish between hardware and software problems

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

   - the hands-on experience
   - the instructor was knowledgeable and enthusiastic

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

   - not enought time for exercises
   - review of introductory materials

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

   - make the course longer

5. ARE THERE ANY OTHER COURSES YOU WOULD LIKE TO SEE OFFERED?

   - other IBM-PC courses

SUMMARY OF COMMENTS: BEGINNING BASIC PROGRAMMING

1. HOW WILL YOU APPLY THE MATERIAL FROM THIS COURSE TO YOUR JOB?

   - data base management
   - to create reports
   - to write programs

2. WHAT DID YOU MOST ENJOY ABOUT THE COURSE?

   - the hands-on experience
   - the graphics

3. WHAT DID YOU LEAST ENJOY ABOUT THE COURSE?

   - not enough time

4. WHAT SUGGESTIONS DO YOU HAVE FOR IMPROVEMENT OF THIS COURSE?

   - make the course longer

5. ARE THERE ANY OTHER COURSES YOU WOULD LIKE TO SEE OFFERED?

   - PC graphics

COMPUTER TRAINING FUTURE:

The information age will cause a request for computer training in all areas of the workplace. The need for excellent computer training wil be increasing as public and industrial demands grow. It will be up to the educators in higher learning institutions to take the lead in demanding that students are trained to meet these societal demands. Computer literacy will be essential tomorrow. Students will graduate from high school into the universities with increased computer skills. But also, universities will be faced with the demand to retrain the worker who entered the workforce with no computer background or skills. To meet these requests, it is recommended that programs be developed which will provide a non-threatening learning environment for the novice computer student. Courses with job-relatedness built into them will help encourage and reinforce student learning with the enticement of job advancement or avoidance of a dead-end job. If the job market diminishes the opportunity for job choices, it will become more evident that the worker with additional job skills will be hired more readily into interesting jobs. Computer skills will make the difference between success or mediocrity. It will become more popular to enroll in advanced computer courses to enhance job skills.

Computer training must increase student awareness of the computer work environment. Office and lab design should anticipate computer needs of the future. Courses should include studies in ergonomics (man's relationship with machines). Students should be aware of the societal needs of employees in the workplace, and that work breaks which move the body and provide personal socialization will avoid boredom and lack of attention. A well-planned workspace must be obtained, with proper lighting for non-glare computer work. Furniture (tables and chairs) must be adjustable to the proper height and angle to prevent fatigue and physical discomfort or damage. Proper ventilation and noise control must be considered. Workspace

should have the surroundings in colors which are most condusive to work productivity, and which reduce the stress of working with machines. Fitness programs will become a part of employee benefits. They will decrease sick leave and ensure mental health and attitudes. Safety in the workplace should be encouraged by regular safety informational programs for workers unfamiliar with working with machines. In computer classes, safety hazards should be discussed to prevent such accidents as spilled coffee or coke onto computers. This may cause a fire due to the acidic content of these substances, or may cause a short in the electronics.

Future computer training will most likely center around the new software packages which will proliferate in the coming years. Many students will request self-study courses as they feel more confident in using better-written manuals and have more computer experience. Video tapes and CAI courses will become popular as large numbers of students may be instructed using this technology rather than the traditional instructor-conducted class.

Higher educational institutions will become familiar with robotics as this technology increases. Labs will be designed in new circular configurations to accommodate a short robot arm, designed to swing in many directions and "plug" into a stationary unit to perform a function during a robotic process instead of the more time-consuming linear lab configuration. Racks similar to electronic racks will be the standard in the automated lab office, holding the essentials for computer-centered work (printer, plotter, and other data retrieval devices for electronic mail and experimental data).

The computer will enhance our lives of the future, but will also cause an enormous impact upon society. Employees may be isolated from other workers, working at home on a terminal to save hours of commuting time. This will eliminate the stimulus of working and sharing creative ideas and the enthusiasm one derives from interpersonal relationships in the workplace.

University teaching will take on a new meaning when institutions are required to prepare students to meet the demands of technology in our changing world. Man must control the technology — technology must not control mankind. Only through well-educated and skilled citizens will future technology advance mankind. The insight and quality of university teaching hold the KEY to our future.

CONCLUSION:

A successful computer training program for the novice computer student should incorporate hands-on training to instill confidence in the student. Choice of instructor is important for the novice to ensure a non-threatening, positive, learning environment. Courses should be designed with relevance to work situations for self-motivation of the student. It is recommended that courses are located away from the workplace to avoid distractions of work. A half-day format enables the student to complete necessary work requirements. Courses should include aspects of computer safety, and the computer workplace of the future, to raise awareness of the changing workplace due to technology.

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EDUCATING THE INFORMATION SOCIETY--REVISED

by

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Mind Nautilus Industries

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Educating the Information Society--Revised

G. M. Moulton

This paper briefly examines five characteristics of the Information Society which have educational significance. These five characteristics raise the issue of whether there is a need to change the educational system in order for it to be more compatible with the educational needs of individuals living in the Information Society. The five characteristics are:

1. a shift from industrial occupations to information occupations (of interest to educators because of the inability to predict the types of jobs and associated skills which will be required)

2. an exponential increase in the amount of information or knowledge created (of interest

to educators for the processing, organization, storage and application problems presented and the speed at which knowledge becomes obsolete)

3. the need for workers to be periodically retrained (of interest to educators because of the need to modify the existing educational system to meet the requirement for additional training)

4. a renewed interest in exploring human potential (of self-explanatory interest to educators)

5. a rapid development of high-technology (of interest to educators because of the application of technology to instruction and learning)

It is assumed the reader has general knowledge of the nature and components of the Information Society.[1] A discussion of the nature of the Information Society is beyond the scope of this paper. The topic is adequately dealt with elsewhere (Masuda, 1980). It is also assumed the reader has general knowledge of the developing technologies (i.e. computers, networks, telecommunications, interactive video, etc.) which have a potential educational application and are the foundation of the Information Society (Singer, 1982). Emphasis is placed on computer technology in this paper.

At the conclusion of this paper answers are proposed to three questions:

1. Will teaching, as we know it, change?

2. Will technology replace traditional in-

[1] A shift in the main section of the American economy away from "smokestack" manufacturing industries to those based on information, services and new technologies.

struction?

3. What role will the educator play in the Information Society?

Occupation Transition

One of the principal functions of schooling is to prepare students to become responsible members of society. This function is translated to mean: teaching students so they will be able to get a job. In a survey completed in 1982, 86% of the adults surveyed rated preparation for a career as the most important reason for going to college (Solorzano, 1983). It is the educators' hope that the curricula of high school, college and university (drawn from the skills which will be needed in x number and type of occupations) and the present occupation and skill needs of the job market are in harmony. The Information Society impairs the ability to predict the type of jobs which will be needed or available and the related skills which will be required in those jobs (Abbott, 1978).

Table 1 contains a forecast of the United States job market in terms of the jobs which will be significantly effected by robotics and computers and/or created by those technologies in the next twenty years.

TABLE 1: U.S. Job Market Forecast (1990)

Occupation:	Total Number of Jobs: (Million):
Industrial Laser Technicians	2.5
Housing Rehabilitation Technicians	1.75
Robot Production Technicians	1.5
Energy Technicians	1.5
Hazardous Waste Technicians	1.5
Paramedics	1.3
Geriatric Social Workers	1.0
Materials Utilization Technicians	0.5
Fuel cell and battery Technicians	0.25
Bionic appendages Technicians	0.2
Holographic Specialists	0.2
Genetic engineering Technicians	0.15

(Cetron, 1982)

Given the general function of education, the fact that students entering college are seeking a career and the rapidly changing occupational scene there is a major task presented to post-secondary administrators to develop a system which is quickly responsive to supplying individuals qualified to assume futuristic occupations. (Note: Complicating the administrators' task is the finding that by 1990 from 900,000 to 2,000,000 (of 2,444,000) of the high school graduates will not have obtained the essential skills needed to be employed (Forbes, 1982)).

Information Explosion

Hillard described the knowledge explosion as follows:

> "At the rate at which knowledge is growing, by the time the child born today (i.e. 1978) graduates from college, the amount of knowledge in the world will be four times as great. By the time that same child is 50 years old; it will be 32 times as great, and 97% of everything known in the world will have been learned since the time the child was born." (Abbott, 1978, p. 101)

Winner listed four assumptions concerning this information explosion phenomena which have been suggested to necessitate large scale social changes (to include, it would be assumed, the educational system). The four assumptions are:

1. people are bereft of information
2. information is knowledge
3. knowledge is power
4. increasing access to information enhances democracy and equalizes social power (Winner, 1984)

The foundation for these assumptions is that ignorance and forced restrictions on knowledge are somehow to be avoided. Connecting individuals to data banks and communication systems, for example, is judged to be a progressive and advantageous step. Winner's article questions the logic of such solutions to the information explosion. He concluded:

> "Computerization resembles other vast, almost subconscious experiments in modern social and technological history. Following a step-by-step process of improvements in technology, societies create new institutions, new patterns of behavior, new sensibilities, and new contexts for the exercise of power. By calling such changes "revolutionary," people tacitly acknowledge

> that these changes are matters that require reflection; possibly they even require strong public action to ensure that the outcomes are desirable. Yet the occasions in our society for reflection, debate, and public choice are new rare indeed. The important decisions are left in private hands inspired by narrowly focused economic motives. While it is widely recognized that these decisions add up in ways that have profound consequences for our common life, few seem prepared to own up to that fact. Some observers forecast that the computer revolution will be guided by new wonders in artificial intelligence. Its present course is influenced by something much more familiar: the absent mind." (p.96)

One of the focal points in the information explosion is the microcomputer. The extent of this emphasis is such that the term, course and curriculum--computer literacy--has been founded. There have been two types of evaluations on the matter; one side, represented by the Office of Technology Assessment (lack of school funds, limited computer literacy among instructors and students, lack of high quality educational software) and the other side represented by experts who are optimistic (computer literacy as a required course, computer science curricula in high schools, the preference for Pascal, Logo and Basic as computer languages). It appears that to serve the development of technology a case is being made for the modification of existing educational and social structures. As a counterattack to this situation technology should be used to examine how knowledge is acquired, represented, used and controlled.

To phrase it differently: What came first, the information

or the explosion? Rather than focusing on the quantitative aspects (which would result in implusive suggestions such as "hooking all students up to data banks") the qualitative aspects should be addressed (Waldrop, 1984). Discussed in this regard emphasis should be focused on the examination of the machine equivalence of human memory, the integration of knowledge into the problem-solving and planning process and the nature of learning. The so-called mind-mirroring programming of computers places emphasis on the process of learning. Theoretically the person who understands how knowledge is assimilated will find it easier to learn new subjects and will, in general, be a better citizen than an individual whose education has been confined to the mastery of particular skills and facts (Watt, 1983). Another researcher has labeled this the process versus the product model--a move from "textbook learning" to "learning while doing". This change of emphasis will have as its focus learning-independent tasks or skills (skills that have to do with learning how to learn and learning more effectively and efficiently and, if appropriate, compensating the individual learner).

Need for Periodic Retraining

The need for individuals to be periodically retrained has become known by the alliterative and education sounding term: life-long learning. Periodically retrained has been trans-

lated as four complete "schoolings" in which skilled workers will be totally retrained (Abbott, 1978). The challenge to educators to meet the educational needs of a citizenry requiring life-long learning is an opportunity to assess, in a formative way, the application of technology within existing institutions. Traditional institutions have been seen as either unwilling or perhaps unable to adapt because of a decline in resources (U. S. Congress, Office of Technology Assessment and Waggoner, 1984). There is no lack of technological innovations to fill the void which may be left by traditional institutions. Each new satellite launched brings with it approximately 20 potential "TV" stations and a statement regarding the educational possibilities. The educational applications are largely unexploited. Control Data's Plato system can provide training, for example, in flying a 747. The system has yet to be fully exploited. The interface between video and computer technologies is unexploited. The most significant advances will be made by educators, with and without institutional support, exploiting the technology to serve the life-long learning need.

In spite of the technological skills which supposedly will be needed and the futuristic occupations which individuals will need training in an examination of the particular skills required in the Information Society reveal skills which will not be easily accomplished without traditional educa-

tional intervention. For example:

1. comprehensive literacy to include the full range of knowledge, skills, attitudes and communication functions--reading, writing, speaking and listening (see Bennett, 1984)

2. higher order competency than ordinarily associated with basic skills; these include information processing, concept information, problem-solving, conflict management, issue analysis and creative thinking

3. literacy drawn from the full spectrum of communication arts, sciences and technology (Work, 1982)

The expanded need for education (i.e. beyond one diploma) will result in a blurring of the lines between school, home, workplace and community (Singer, 1982 and Atwell, 1984). Technology will be used to increase educator productivity and meet the demand for supplemental education in a cost effective manner (Melmed, 1984). A lack of funds, inadequately trained educators (in terms of familiarity with the developing technology) and lack of leadership will only slow the educational response.

Interest in Human Potential

Through each period in history man has achieved an evolutionary milestone. These milestones have been associated with particular inventions or discoveries. This was graphically illustrated in the movie: 2001 in which the discovery of tool use occupied the initial scenes. Each invention or discovery has enabled man to do more and placed him on the frontier of the next evolutionary step. The automobile,

electricity and the telephone (to name but a few) made possible space travel and miniaturization. Technological advances, with specific emphasis on space have recently begun to focus on what can be learned from other beings--witness E.T. and Close Encounters. Developments in space travel with its associated spinoffs in microchip technology have enabled us to conceive of such things as "The Force". In a similar vein recent critiques of the educational system have eluded to the present opportunity to "stretch one's mind" to its full capacity (Davies, 1983 and Passow, 1984). With specific emphasis on microcomputer technology and its associated programs a recommendation is noted to advance beyond simple mastery of basic skills through drill and practice (i.e. the initial use of computer technology and the nature of computer-assisted-instruction) to the development of programs that represent the next logical step in the development of computers (Watt, 1983 and Brown, 1983). With each advancement in technology comes an appreciation and wonder of mankind. The human is smarter and more capable than traditionally acknowledged and the development of technology is the first to mirror our innate abilities. Extrasensory perception, psychic perception, alter-states processing are being integrated with the higher intellectual skills of creativity, deductive and inductive logic and are being suggested as valid and relevant curriculum areas

(Galyean, 1983 and Dodd, 1984).

We are getting smarter and we are making smarter machines. These skills and abilities must be integrated into the curriculum. The result of such training and education may revolutionize education and learning practice (Straham, 1983).

Development of Technology

Microcomputer technology is one of the "hot" educational topics of the day. The educational application of this technology has not gone unnoticed. Well over 5 million personal computers have found their way into this nation's homes with 46% of the purchasers reporting they purchased the machine with the hope of using it in an educational application. An additional 325,000 microcomputers are in classrooms across the United States. The technology which is developing so rapidly is overtaking traditional educational caution--estimates for 1987 indicate that 1.2 million computers will be in classrooms across the U.S. and an estimated 600 million dollars will be spent on educational software. Technological developments are placing us on the brink of a quantum leap into the future. Is the arrival of the computer in the classroom a marketing ploy or does microcomputer technology hold educational promise? The jury is still out with reference to this technological marvel. In spite of this increase in available technology and the effect that it will have on occupations the educa-

tional: "What do we want to do with it?" has not been addressed (Bernstein, 1983). In an extensive examination of this nation's schools Goodlad found routine inconsistency between practice and ideal (computer-assisted-instruction perhaps could be considered an ideal) (Goodlad, 1984). The questions being forwarded and addressed are still very basic ones, for example, will this technology be used for teacher productivity or human potential expansion? The overall evaluation is that the structure of education has not been changed consistent with technological development. They are perhaps incompatible in their present form (Griffen, 1983 and Masterton, 1984).

Discussion

There are four conclusions which can be made from the information presented in this paper. They are:

1. educators will lose the ability to project the occupations for which they will be preparing students in the future and they will be responsible, either directly or indirectly, for periodic retraining

2. educators have at least as significant a role (and school a function) in the Information Society as they had in the Industrial Society, in particular with reference to an extensive examination of the limits of human potential; at the very least educators will be the professionals responsible for insuring the appropriate use of technology (i.e. that technology will be used at its highest level)

3. opportunities for the educational entrepreneur exist

4. leadership in educating the Information Society will rest with high school, college and university faculties

Briefly; the major reason for the attention focused on education (example, the National Commission on Excellence in Education) has come about as a result of the rapidity with which occupations and industries are being changed. For example, the need for engineers is reflected in faculty requirements down to the high school level and curricula needs down to the elementary school level. The response of the educational community must be comparable to the way in which a manufacturer meets a demand for product. The response should also go beyond the quantitative--more home-work, academic requirements, etc.. As opposed to focusing on curriculum changes or modification of programs attention should be on process and expansion of the learning and intellectual skills required. This can be done if preparation through the basic skill area has been adequate and multiple and alternative learning opportunities are present. A change in the structure of education may be necessary to accomplish this goal.

In the area of entrepreneurship some preliminary advances have been made--educational systems as high-technology business and alternative degree programs. Educators will continue to look at educational needs and existing technology and put together educational programs which are educationally

relevant.

There is indeed a negative and a positive side to all of this information. The characteristics of the Information Society could as easily be used to justify a total swing to "back to basics" in the traditional sense or the justification of the cosmopolitan-educated individual (one with little knowledge in all subjects and a well developed ability to quickly respond to new situations by plugging himself/herself into some kind of knowledge factory. The common factor appears to be total development of the learning abilities in all areas of human intelligence. Technology in hand has made this possible and will enable the next evolutionary step to be taken.

Proposed Answers

Question 1: Will teaching evolve? No. Human learning potential will evolve and bring with it curricula and methodology changes.

Question 2: Will technology replace traditional methodology? No. Traditional methodology will represent a smaller percentage of the manner in which knowledge or an education is acquired.

Question 3: What is the role for traditional education? The total development of human potential; the total development of the learner.

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ARTIFICIAL INTELLIGENCE AND THE UNIVERSITY COVENANT: SPECULATIONS ABOUT THE IMPACT OF TECHNOLOGY ON THE PURPOSES OF EDUCATION

by

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ARTIFICIAL INTELLIGENCE AND THE UNIVERSITY COVENANT: SPECULATIONS ABOUT THE IMPACT OF TECHNOLOGY ON THE PURPOSES OF EDUCATION

by Eugenie Potter

It is difficult to predict,
especially the future.
_Feigenbaum and McCorduck

My paper differs perhaps from many of the others at this conference in that I have no new and exciting teaching techniques to share with you. Nor do I have any research results that will demonstrate the efficacy of one college curriculum over another in preparing our students for the so-called "real world." Rather I should like to provoke your thoughts about the reasons that you and I and all of us in education do what it is we do. By the title of my paper, it might appear that I am talking about something called "the future," but in fact I am talking about today as much as -- perhaps more than -- tomorrow.

If we were to review the history of education, characterizing its functions as we did so, we would find that education generally has served three primary purposes:

1. the preservation and transmission of the culture -- this purpose pervades all education but is most clearly seen in homogeneous societies. Indeed, one of the principal problems of tribal groups, such as Native Americans in this country, is the struggle to hold on to their inherited culture while at the

same time learning the skills necessary to compete successfully outside their groups (1);

2. the preparation of the young for economically productive lives -- this purpose forms the backbone of formal education in modern industrialized countries. In their book Schooling in Capitalist America, Bowles and Gintis stated that American education is designed to inculcate from the earliest grades onward the norms and values of the workplace: promptness, discipline, respect for authority, etc. (2);
3. the development of individual intellectual and social capabilities -- we tend to think of this purpose as a distinctively modern one, but it can be found repeatedly in the history of education: in the schools of Periclean Athens, in those of the Renaissance humanists, and in those of the great 17th century reformer Jean Comenius to cite just a few examples (3).

To these three purposes we can add a fourth fulfilled by colleges and universities: the generation of new knowledge through academic research. Those educational purposes might seem to be "eternal" -- they seem to have been around forever and seem likely to continue as long as the human race does.

I should like to take a contrary view, however, and say that the computer-related technology now available, to say

nothing of that which will come into being with the next generation or two of computers, has the potential for challenging those fundamental purposes of education and with it, our fundamental assumptions about who we are as human beings.

To begin to understand the potential of that impact, I should like to ask you to indulge in a sweet fantasy. Try to imagine for a moment that you suddenly became independently wealthy. Pick any sum -- $10,000, 100 million, whatever -- that, if you had it, would release you from the necessity of work, that would purchase all your heart's desires, that would enable you to do anything you wanted. What, then, would you do with your life?

Seventy or eighty years is a long time to fill with activity. After the immediate imperatives -- the mortgage, the kids' dental work, a decent amount in a retirement account -- had been taken care of, after the desire for material goods had been sated, after trips to far-away, exotic places had renewed the value of home and friends, what then? What would give your life meaning?

For most of us the question may seem silly, a never-to-be-had dream. But it is one that may face our children, or theirs, and through them, the structures and institutions of society that today we take for granted. The technology now among us holds the potential for transforming our society from one in which an individual's value is measured by

the work he or she does to one that is very nearly "workless." Let us examine some evidence for that statement.

In a November 1982, issue of Forbes Magazine, James Cook wrote that almost all the tools invented by humankind since its primitive beginning had been designed to relieve the work of the back and the hand; computer-related technology had been designed to relieve the work of the mind (4). Workers displaced by industrial technology in the 19th and 20th centuries sometimes reacted violently, but ultimately the technology led to new industries and thus to new jobs for them.

Many forecasters think the same will hold true for the new technology. Others do not agree. The Department of Labor estimates that technology will have cost the U.S. three million jobs between 1980 and 1990, and at least seven million by the year 2000 (4). These are jobs at the structural level, that is, jobs of such a type that the displaced workers cannot find similar employment by moving to another company or to another area of the country. They must learn new skills. For many it is too late, they are at an age when involuntary retirement is the best option (4).

Those who do avail themselves of retraining often -- perhaps usually -- find themselves in low-paying, dull, repetitive jobs that are themselves subject to obsolescence through the use of such technology as robotics (5). But, you may argue, all that is part of the change from an industrial

to a service economy. The new jobs are in human, not machine-oriented work places. Indeed, that is true.

Let us look a little more closely, however, at the impact of technology on the service sector. In general the service economy is defined as the occupations that provide services rather than goods, although the handling of goods may be part of the service. Thus service contrasts with agricultural production, extractive processes (mining and petroleum, for example) and manufacturing processes.

We in education share the service sector with those in health care, in government and other public services, in banking and related industries, and in wholesale and retail trade. Ours is the sector designated "white collar." We have more trained technicians, more managers, higher levels of education, and higher individual incomes (6), although these attributes depend, of course, on where in a broad spectrum an individual job occurs.

For us the computer is simply a tool to make our working life easier and more productive. But is it just that?

In a recent article by the Associated Press, bankers were said to be expressing concern about some unforeseen consequences of computer use by real estate offices. As it happens, individual real estate offices can now have, through computer/telephone links, the latest comparative information on mortgage rates, points, funding options, and

all of the other financial paraphernalia that goes into a competitive "package" for their clients. Furthermore, through that same technology, the clients' credit reliability can be determined, the forms for processing the transaction can be generated, and the transaction itself can be made -- all in a matter of an hour or so. The client need not leave the comfortable chair in the real estate office (7).

The banker, whose profession as middleman in such transactions dates at least from the Renaissance, is being replaced by a machine that, even in a highly sophisticated version, today costs less than $5000. Similar tales can be told about stock brokerage, car sales, tax and accounting firms, and other occupations that just a few years ago were thought to be immune to the displacement effects of technology.

Ah, you may object, but those are generalized occupations. The machines can't replace specialists, people with high educational levels in highly specific areas such as engineering, medicine and teaching.

How accurate is that objection? Let us consider some of the potential of artificial intelligence.

Artificial intelligence is that area of computer-based research that attempts to "mak[e] machines do things that would require intelligence if done by [humans]" (8). The field is broad, taking in all three domains in Bloom's

taxonomy of learning: the psycho-motor, the cognitive, and the affective.

Most commercial applications of artificial intelligence are in the areas of robotics and expert systems. Robotics is understood, I think, at least in a general way. It may be useful, however, to describe expert systems.

Expert systems are computer programs that contain a large body of information about a specific subject, usually called a "knowledge base." They also contain algorithms, or rules, that operate on the knowledge base to produce a result. The various types of expert systems differ in many ways, including the structure of the knowledge base, the types of algorithms used, the bases for process and product decisions, and, of course, in the level of complexity and sophistication.

Whether simple or complex, however, they have in common two things: first, the knowledge bases and algorithms represent the pooled knowledge and decision rules of many experts in the field, and, second, they have the ability to do what we would customarily term an intelligent process: take information, apply rules to it, make inferences, and draw conclusions (9).

Let me illustrate some applications of expert systems. The field of geologic exploration is highly expensive not only because of the equipment used and the cost of purchasing mineral rights in areas that may or may not yield

returns, but also because mining and petroleum firms must employ the expertise of highly educated (therefore expensive) staff geologists.

A few years ago SRI International, a research firm in Menlo Park, CA, in cooperation with geologists from the U.S. Geological Survey, developed an expert system called PROSPECTOR. The system's knowledge base contained general information about geology and mineralogy and, in addition, could be given information about geologic conditions of specific regions.

The system was purchased by a large company. It paid itself off almost immediately by predicting a find in an area where company experts had not supposed there would be one. In fact the company had for years been dumping tailings from a nearby mine on the site of the deposit predicted by the PROSPECTOR program (10).

Another example -- CADUSEUS is a medical program that can diagnose over 2800 diseases while taking into consideration such factors as personal habits, environmental exposure, and travel (11). Although it is designed for use in large clinics and in teaching hospitals to both teach and test the knowledge of medical students, it can conceivably be used as well in the general medical field to assist the diagnoses of practicing physicians or in remote locations to aid nurse practitioners, paramedics and others without broad medical training. It is also conceivable that in the future

we as patients may be able through home computers and telephone lines to gain access to a similar program, describe our symptoms, and receive a diagnosis and prescription -- along with a bill for services, of course!

The purpose of these illustrations is not to fill you with awe for the prospective power of technology -- although there is reason aplenty for awe -- but rather it is to demonstrate that there are few occupations we can consider that are not likely to feel the effect of the machines that are designed to relieve the work of the mind as well as that of the hand and the back.

There are some who are concerned about this prospect on economic grounds: if we are bereft of the means for earning an income, how then will we as individuals and the economy in general be sustained? Nobel laureate economist, Wassily Leontiev, stated the matter this way:

> Adam and Eve enjoyed, before they were expelled from Paradise, a high standard of living without working. After their expulsion they and their successors were condemned to eke out a miserable existence working from dawn to dusk. The history of technological progress over the past 200 years is essentially the story of the human species working its way slowly and steadily back into Paradise. What would happen, however,if we suddenly found ourselves in it? With all goods and services provided without work, no one would be gainfully employed. Being unemployed means receiving no wages. As a result, until appropriate new income policies were formulated to fit the changed technological conditions, everyone would starve in Paradise (12).

Leontiev, being a humanist and a good teacher as well as a good theorist, went on to allay the fear of star-

vation by recommending some alternative means for distributing income. My concern today, however, is not with the direct economic implications of technological change, but is rather with its effects on the purposes of education.

Let me state here some fundamental and optimistic assumptions:

1. that the human race will continue; that is, that the political and ideological differences that seem to be part of our human inheritance will not have led us to use nuclear force as a solution;
2. that the economic problems of transition foreseen by Leontiev and others will have been found and that we will not be starving in Paradise;
3. that the capability of thinking machines foreshadowed by the kinds of expert systems I have described will have been realized and turned to good purpose.

Let use turn now to the implications of technology for the purposes of education. If we look at the three fundamental purposes, that is, the preparation for work, the preservation and transmission of the culture, and the development of individual potential, we can readily see that technology may have a severe impact on the preparationist purpose. In fact a number of national reports in recent years have stated that narrow vocational training is inappropriate in today's rapidly changing employment world (13).

Many jobs for which high school graduates, two-year college students and even baccalaureate degree holders have prepared themselves maybe obsolete within a few years after the new graduate has begun working (14). Continuous vocational retraining may be a better way to state this educational purpose today. We have seen, too, that even those with advanced degrees cannot be assured that their specialized knowledge cannot be codified and made accessible -- relatively inexpensively -- through expert systems.

That is <u>today's</u> reality. What of tomorrow? Artificially intelligent machines and their less intelligent cohorts, the robots, do not require long years of training to acquire their skills. Nor do they require inculcation in the norms and values of the workplace. What happens, then, to the preparationist purpose of education?

Teachers of the humanities, the classics, the arts may find their hearts lifting with joy -- the post-technological era will be another Golden Age of attention to what John Dewey called "the inherited riches of the race" (15).

Let me sprinkle a little cold water on that idea by suggesting two things: first, the current resurgence of interest in general education has stemmed, at least in part, from the advocates' insistence that the kind of skills learned through general education carry into the workplace and , in fact, enhance the graduates' ability to succeed in a career (16); second, perhaps one reason that the humani-

ties, the classics, and the arts have the vividness they do for us today is that they stand in contrast to the often pedestrian workaday world in which most of us live.

What may happen to that vividness when there is not that contrast? In this country we have not had a cultural tradition of a leisured aristocracy in whom an appreciation of "the finer things in life" is passed from generation to generation. We have chosen instead to pluralize appreciation. Will it be possible in a leisure society not only to sustain that approach but to make it a cornerstone of cultural tradition, as well?

Let me treat another aspect of the cultural transmission purpose of education. We sometimes assume that Culture -- with a capital "C" -- is what education preserves and transmits. Yet Bowles and Gintis, whom I cited earlier, stated that education inculcates the "norms and values" of the workplace. Norms and values form the core of almost any definition of "culture" that one might pluck from a social science textbook.

In our society norms and values are bound like Siamese twins to the work ethic. Therefore, to suggest today that a double digit unemployment rate may be the harbinger of the new society and that income will have to be redistributed according to a new, emerging workless ethic is to do violence to our culture's traditional measures of individual

worth. What cultural tradition, then are we to preserve and transmit as fulfillment of our educational purpose?

If the post-technological society deprives us of the work preparationist purpose and perhaps as well of the purpose to preserve and transmit the culture, surely that third fundamental purpose of developing individual potential must hold true. After all, in a workless society what is left except individual development.

But there is a problem here as well. Individual potential exists in contrast to some standard, often historical. Individual potential also develops within a context. We can recognize outstanding achievement in today's world through comparison and contrast with our own cultural context. It is impossible to imagine how individual potential and individual excellence might be defined in the post-technological future. The question before us today, however, is whether formal education is likely to be a necessary part of that developmental process.

This apocalyptic litany may lead you to conclude either that we should take immediate Luddite action against the advance of technology or else that we, or perhaps our children, should declare education dead and bury it -- with all suitable sentiments, naturally. I have been deliberately provocative because, of course, I should like to suggest another alternative. Before I do, however, perhaps I should extend some reassurance.

A recent gathering of artificial intelligence experts, reporting to the Congressional Office of Technology Assessment, stated their opinion that a true leisure society might never occur, but that if it did, it is at least 75 to 100 years in the future. They also said, however, that the interaction between technology and employment will be a critical area for social policy from now until well into the next century (17).

That means that for those of us in education it is not too soon to begin thinking about the purposes of education in a post-technological society. I would submit, however, that "the future" is the wrong time frame. Educational philosopher, T. Frank Saunders, has remarked, "The future is a remarkable kind of value imperative whose progeny is the present"(18).

If we peer beneath the purposes of education that I have outlined today, we can perhaps discern a common ground: each is concerned in its own way with stating what it is that we mean by "human." The birds and the beasts sustain themselves but don't labor to increase their wealth. Neither, however, do they transmit a cultural heritage, enriching it creatively in each succeeding generation. They are truly existential beings.

Ours is a different covenant. We are neither existential beast nor machine.

If we fix solely upon the economic prospects of

artificially intelligent machines, we overlook, I think, the opportunity that the presence of those machines affords us to examine deeply the ethical and aesthetic values by which we define our humanness.

Artificial intelligence has the potential for stripping from us so many of the comfortable, convenient ways we now answer the questions "Who are you?" and "What are you?" It challenges us to define ourselves in other than existential terms, in other than work-related terms, in other than cognitive capability terms, as part of -- but something more than -- inheritors of a cultural tradition.

In the end it does not really matter whether artificially intelligent machines do all the work of the world. That is a problem of condition, not essence. Nor does it matter if the machines eventually are programmed to have feelings, mental states, values. We already have those. What matters is what we choose to do with them.

We began this discourse with a "million dollar question." Those of you who answered silently, "I'd do exactly what I'm doing now," are the fortunate among us. I would suggest that education's million dollar question <u>ought</u> to have something of the same answer.

Philosopher F.E. Sparshott, remarking on the applicability of philosophical inquiry to everyday life, said:

> Perhaps in the end all philosophy is a philosophy of man; but it is of ethics and aesthetics, which avowedly deal with what man makes of himself, of his

world and of his relations with his fellows, that this is most obviously true (19).

If we choose today to extrapolate the traditional purposes of education into the post-technological future, we may find that our enterprise has no reason for being. If, however, we choose to make education an aesthetic experience by developing in ourselves and our students the joy of inquiry, and, further, if we shape that inquiry around the ethical problems of sifting and sorting and deciding what it is that we are to make of ourselves and of our world, then we have made a covenant that transcends mere technological change. It is a covenant that joins the present with our heritage and our future. It makes of education that process in which values and commitments come together to define what it is we most truly mean by "human."

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TEACHING, TECHNOLOGY, AND THE FUTURE

by

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TEACHING, TECHNOLOGY, AND THE FUTURE

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Teaching

The advent of the 1980's has brought the issues of effective teaching to the foreground. Falling enrollments in higher education and the conservative mood of legislators have seriously affected the budgets of educational institutions. Although good teachers have always been in demand, recently, increased attention has been placed on teaching effectiveness. Contemporary conditions, such as civil rights suits resulting from performance evaluations or the misuse of tenure as a means of employment security rather than as an environment for seeking and teaching the truth, have caused the professional teacher and administrator to explore measurable factors associated with teaching effectiveness.

Attempts to operationally define good teaching or to characterize an effective teacher have produced varying and often vague results. Rouche and Watkins while discussing "great" teaching in a community college setting cite Hildegrand and Wilson who suggest that the instructor should go beyond simply delivering facts, patterns or themes, or implications or concepts to support facts. They emphasize the instructor should be clear, well organized and effectively use examples and appropriate analogies. Further, the instructor must be able to effectively manage groups - control, pace, and stimulate effective interaction[1]. According to Hildegrand and Wilson genuine concern

for learners as individuals is an essential part of relevant pedagogy and the teacher's eager interest for teaching his subject is absolutely necessary! Rouche and Watkins also cite Schneider et. al. in their study which describes effective teachers of adults as "those who successfully perform a balancing act. They balance classroom teaching with mentoring or advising on a one-to-one basis; student centeredness with highly directive and prescriptive behavior; a clear focus on task with creative, flexible options for student participation".[2] They go on to say that "excellent faculty are those who engage students in their own learning while demanding excellence."[3]

"Good teaching", according to Lewis, has been defined as "what the teacher does to produce inspired pupils, excited pupils, interested pupils, creative pupils, pupils who are good citizens, who can read, do arithmetic problems and write grammatical English essays." Lewis goes on to define good teaching as "developing critical thinking, subject matter mastery, ideals, love of freedom, respect for law and order, universal brotherhood, various attributes of character, a love of learning and a devotion to the arts."[4]

Roush reviewed the literature on university teaching from the late 1960's to 1983. He identified factors critical to college teaching success which included:

"A. Excellent knowledge of subject matter.
B. Dynamic classroom relationships and ability to evoke meaningful classroom response.
C. Ability to involve students in their own education.
D. Enthusiasm for subject and teaching.
E. Empathetic understanding of the student."[5]

Additionally he identifies fairness in assessment and teacher impact on students outside the classroom as critical in effective teaching. Roush also believes teachers of distinction and imagination can develop creativity and values in teaching that are significant in teaching effectiveness.

Williams present an interesting treatise on "How to Teach.... Badly". He said that beyond the freshmen year students have more experience, but not necessarily better teachers. Reasons for the lack of excellence in teaching are principally five, "First, it is rare to find any teacher who has not succumbed ...to the pressures of the system in the matter of examinations, grades, and credits. The ideal he holds up to himself is to teach a good stiff course.... A second reason why teachers of upper classes are seldom good teachers....is that they somehow get the notion that 'upholding the standards of the university' means essentially giving many low grades. A third reason...is the idea that learning is unpleasant work. A fourth reason for bad teaching is mere negligence and indifference on the part of the professor. A final reason..... is the lack of a personality that can put itself in rapport with many types of student personalities, understand how to interest and stimulate young minds, and perceive the many facets that many minds may discover in most types of human knowledge."[6]

The attempts at accurately defining excellence in teaching goes on and on and the need for a measureable, clear, operational definition still exists. For purposes of this paper, the competencies characteristic of "good" teachers include: excellent knowledge of subject area; good organization; enthusiasm for subject and teaching; empathy toward students; good communications; fairness and impartiality; adaptablity to new techniques and knowledge; development of creative and inquiring minds; a sense of humor.

One of the many ways the educator can attempt to improve his effectiveness is through the use of "high tech" aids. Historically, the classroom lecture has been the dominant means of educational delivery. Yet today the teacher is confronted with peers, administrators, and salesmen

encouraging the use of various technological schemes to improve teaching effectiveness.

Technologies

Twenty years ago terms such as computer assisted/managed instruction, audio tape cassettes, microcomputer-based courses, video discs, push button materials and geostationary satellites were uncommon or did not exist. The use of these technologies has in turn helped to introduce new concepts such as value added instruction and distance learning.

Technological Educational Methods-Will They Help?

The wise use of technology such as audio-visual aids or computers in teaching can create excitement and enthusiasm in the educational environment. Computers, for example, can improve efficiency in storing and retrieving data and can be a great source of pleasure while acquiring new knowledge. High tech equipment in teaching should be viewed as an additional resource to improve teaching.

This technology can greatly assist students who wish to learn on their own. While discussing newer trends in teaching, Boaz describes self-paced instruction as "a departure from traditional regular class meetings. Self-paced instruction and the use of television programming to instruct students are alternative teaching methods."[7] Through technology, students who live great distances from campus can still be actively involved in curricular activities and, at the same time, influential experts can share their knowledge on campus through telecommunications and video.

Senese believes, "The computer, as well as other technological innovations, can provide us with a means of offering improved educational opportunities in a cost effective manner."[8] Kemp agrees and suggests, "Based on learning theory and communications research, the technology of instruction provides the means whereby learning can be effective and efficient."[9] He emphasizes the value of audio visual materials in learning by adding that "they make education more productive, individual, immediate, equal for learners and give instruction a more scientific base."[10] The same advantages can probably be cited for other high tech teaching technologies.

Denton et. al., examined instructional strategies while exploring the effectiveness of two-way television. Based on data collected from 32 presentations by 7 professors in the College of Medicine at Texas A&M University over 9 months they concluded that "...achievement was at least as high on materials presented over two-way television as they were on materials presented with the professor present in the classroom."[11]

If a teacher is effective, the appropriate use of a high tech teaching mechanism will increase teaching effectiveness. It will do so not necessarily because of the high tech equipment, but because the effective educator has the intuitive - if not the technical - ability to select and use technological equipment to enhance his skills. Technology should be an additional tool in his teaching arsenal; a tool which he will use to create situations in which students will learn more effectively.

Limitations To The Use Of High Tech Technologies

It is highly unlikely that all the technologies produced by high tech companies can do much to improve teaching effectiveness if an instructor lacks teaching ability. Technological teaching methods cannot be used as a prop to

improve poor teaching. Likewise, they can do little to improve the skill of a poor communicator, or the teacher with little enthusiasm, organization or counseling ability.

Herschbach identifies some areas of concern in the use of educational technology. He says: "1. Technology producers and the public are leading the movement for educational technology, but no coherent policy exists... 2. Educational technology, particularly software, is not at the present time cost effective. [This is not in exact agreement with Senese!] 3. Educational technology is not necessarily more effective than conventional educational techniques. 4. Educational technology is used more for 'value added' instruction that has a positive effect on students, although it is difficult to measure."[12] Sardello in describing the technological threat to education suggests, "Microcomputers in the classroom pose a technological threat to learning because they transform education into psychology."[13] In the same manner, Simpson warns that "computers can be a valuable instructional device when they are used to support teachers rather than replace them."[14]

Knapper while discussing barriers to adoption of instructional technology states, "...research evidence for the effectiveness of technology based instruction compared to traditional teaching methods is equivocal" and he goes on to say, "Furthermore, teachers may be understandably reluctant to relinquish the minute-by minute control over the learning process to a technology based system that they barely understand."[15]

Non-acceptance of technology in adult education may also be a problem as Knapper notes, "Learners - particularly the increasing population of mature students - often place a high value on human and social contacts and may

resist teaching that is controlled primarily by a machine, however ingeniously it is programmed."[16]

The Professor

Teachers have a habit of teaching the way they have been taught. Those who have not been exposed to curricula which improve teaching communication skills lack appreciation for different or improved teaching methods. It is doubtful, for example, that the curriculum required for a Ph.D. in biology would require any courses in teaching methods or technological teaching methods. Furthermore, the likelihood of receiving effective teaching training through such biological courses is marginal. Having been "awarded" a doctorate upon graduation and told by the commencement speaker et. al., of his academic brilliance, it is doubtful if the graduate would be receptive to the idea that his teaching could be improved. Certainly it would not seem to him that any of his colleagues (much less administrators) could improve his teaching.

Change, however, is all around the teacher. As decreased budgets, declining enrollments, and student/teacher evaluations begin to exert pressure, his boss will begin urging him to improve his teaching skills. While the teacher may have experience, experience alone will not suffice.

All this change will not be easy for the instructor or the organization. While discussing such things, Rogers cites Bagehot as he says, "One of the greatest pains to human nature is the pain of a new idea. It...makes you think that after all, your favorite notions may be wrong, your firmest beliefs ill-founded... Naturally, therefore, common men hate a new idea, and are disposed more or less, to ill-treat the original man who brings it."[17] Frye adds another dimension to this problem as he states, "Adoption of new technologies will be delayed because most schools which cannot adapt to the

new technologies may face aggressive competition for students from those who can."[18] He also notes, "Faculty needs reassurance that improving productivity through new learning systems will not result in a loss of status or benefits."[19] He then adds,..."faculty should understand that breaking the constraints of classroom instruction can lead to greater rewards and success. In new systems the faculty member is often more of a learning manager than a classroom teacher."[20]

Cross espoused the proposition that "college teaching can be improved... because improvement is desperately needed and...we do know how to do it... but...[we are] less sanguine that it will be improved." In her study of 706 responses from a randomly selected sample of roughly half of the faculty on three Nebraska campuses, Cross concluded that "[the professors] are not well informed about knowledge related to the evaluation of teaching, student learning, or instructional innovation, and worse yet, they seem reluctant to learn."[21]

Weaver suggests, however, "Good teachers are made, not born..."[22] Every college professor has the professional obligation to constantly examine technological education methods, try them and adopt those which improve his/her effectiveness as a teacher. To do anything less short changes his students, degrades him professionally and leaves him stale as a teacher. It is professionally immoral for a teacher to use the same notes, or organizational and teaching methods he was using five years ago, much less twenty years ago.

The Administrative Responsibility

The responsibility of the organization in such a situation is to provide opportunities, encouragement and incentives. If administrators are sincere

about their wish to improve teaching, then it is necessary that favorable situations be created where professional growth can be developed. In turn, if administrative rhetoric declares that rewards will follow improved teaching, then ensuing behavior must be consistent with what is said.

Opportunity must also include appropriate supervisory behavior. Professors must have opportunities to see, try, fail and succeed in a positive atmosphere. Enough time must also be allotted to get the "feel" of a new piece of equipment. It is professionally unacceptable to have a training requirement added to already heavy work loads and such a requirement will probably decrease morale and teaching effectiveness. Requiring one to pursue drastic change poses a real threat to one's self-esteem, self-respect and status. It is necessary then for the supervisor to provide encouragement and an environment for improved teaching by helping him through the adoption process. This personal involvement will test the excellence of supervisory abilities, but to settle for less will slow adoption of new equipment.

If a professor has made the effort and results indicate teaching has been improved, then two types of reward must be apparent. First the reward must be evident in his salary. Secondly, and more importantly, he must receive a verbal and written statement of a job well done.

Clearly, teaching excellence is the responsibility of the institution as well as the individual faculty member. Peters and Waterman in their book "In Search of Excellence" provide a significant clue to organizational excellence.[23] They maintain most organizations are composed of average individuals. However, the organizations recognized as excellent have found the means of allowing unusual effort on the part of these average individuals. Logically then, teaching excellence will occur when institutions create the environment to allow the average faculty member to achieve teaching excellence.

The Future

Educational technologies are with us and will continue to be developed at a progressive rate. Payne agrees as she states "There is an emphasis on advanced technology, with computers being used in over 50 percent of all secondary and over 20 percent of all elementary schools throughout the country."[24] As these students - or at least some of them - advance to universities the requirement for professors to use technological tools and be computer literate will inevitably increase.

While predicting the future, nothing can be more certain than that situations will change and the present will never again be the same. It will be a sad day for university faculties if they feel that since they have always had a corner on providing higher education, they will have it in the future. One only has to observe the popularity of the junior and community colleges to realize their students numbers are increasing and - at least partially - at the expense of the 4-year institutions.

A number of private business and training programs already exist in the United States. In a telephone conversation with Comstock, he noted that, "The degree advancement programs offered through such notable organizations as General Motors, Chrysler, Du Pont Chemical, and IBM are for upper divisions of management and engineers to further their skills without the required residence at the university setting. The programs at this time are not accredited but this does not mean much since most advanced graduate programs recognize this type of training and will consider it as prerequisite work toward advanced degrees."[25]

Comstock goes on to say, "a large group of programs offered within business and industry, such as A.T.& T., Texas Instruments, and Sandia Laboratories, develop curriculia cooperatively with universities with degrees

granted through the underwriting universities."[26] Wang Institute of Computer Software, Arthur D. Little, Inc., and the Rand Graduate Institute have developed specialized graduate programs accredited by regional accreditation councils. The Naval Postgraduate Program in San Diego and the Air Force Institute of Technology in Ohio are examples of fully accredited programs designed to meet the needs of the military.

"While", as Comstock indicates, "these programs are not as threatening as one might first perceive, they are here and likely to grow." In the future, those which survive will offer higher education most efficiently and effectively based on - among other things - high quality teaching. Only those who are excellent teachers and who are constantly striving to improve themselves will survive in such an environment. High tech educational resources offer promising and exciting opportunities for those who use them.

Summary

High tech teaching tools are here and their availability and use will accelerate in the future. They offer great opportunities to improve teaching situations as well as allowing interaction among people who are great distances from campus.

All this change, however, will try college administrators and individual professors. Administrators must create positive situations for teachers at all levels to involve themselves in observing, experimenting and adopting new teaching technologies. Since technology can improve teaching, especially of effective teachers, this is an opportunity that cannot be neglected

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"MEGATRENDS" FOR HIGHER EDUCATION

Directions for the Future of College Teaching

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"MEGATRENDS" FOR HIGHER EDUCATION

Directions for the Future of College Teaching

INTRODUCTION

The society of the 1980's and 1990's is considered one where changes in economic, social, personal, and educational forces are considered an ever increasing and more dominant characteristic of our lives [3,4]. The professional field of higher education is logically affected by these changes. Professionals in higher education must continue to view themselves as progressive individuals with a focus on long range, strategic planning. This planning process results in action plans that reflect an awareness of environmental opportunities and threats.

An environmental scan can be based on a number of different perspectives. John Naisbitt's best selling text, MEGATRENDS [1], identifies one possible set of predictions which could serve as the basis for an environmental scan in the field of higher education. Naisbitt's analysis of articles and news bits from hundreds of newspapers around the country provides the basis for his ten "Megatrends." Naisbitt makes it clear that his predictions are not guaranteed forecasts of the future. They are apparent **trends**, conclusions based on the data he has collected. Naisbitt makes it clear that his "Megatrends" are open to debate and modification. They are a format which will lead to a critical evaluation of environmental issues.

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A Research Study

A questionnaire containing a summary of the ten "Megatrends" and an assessment of the probability (0-100%) of the trends occurring and their potential impact (1=low,6=high) was developed.

The "Megatrends" probability impact analysis was used with three professional groups in the general areas of teaching, learning, and management. The survey was used with the College of Business Administration faculty of Marquette University as part of its long range strategic planning process. A second study was done with a national group of business educators. The Association for Business Simulation and Experiential Learning (ABSEL) is an group of educators/consultants who develop computer simulations and structured exercises which are used in both academic and organizational environments. A third study was conducted among training and development professionals of the American Society for Training and Development (ASTD).

While these three groups are not similar, there are similarities which would allow for a comparison of the results. Tables 1 and 2 present the probability and impact ratings for the three groups. Significant differences based on a oneway analysis of variance are indicated.

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Table 1

Higher Education "Megatrends" Summary

MEGATREND	PROBABILITY	IMPACT
We are in a "megashift" from an industrial to an information based society.	75.9	5.33
For every high-technology action, there is a "high-touch" reaction, or the technology will be rejected.	61.5	4.08
Our economy is becoming part of a global structure moving away from isolation and national self-sufficiency. As a result, we will no longer be the world's dominant force.	66.8	4.33
U.S. corporate managers are beginning to think about the long term rather than the next quarter.	49.1	3.91
Our centralized structures are crumbling. We are decentralizing and growing stronger from the bottom up.	50.1	3.92
We are reclaiming our traditional sense of self-reliance after four decades of looking to institutions for help.	50.8	3.66
Citizens, workers, and consumers are demanding and getting a greater voice in government, business, and the marketplace.	57.5	4.30
We are moving from hierarchies to networking; the computer is smashing the pyramid.	55.3	4.32
The North-South shift in the United States is real and irreversible for the foreseeable future.	61.7	3.91
We no longer live in an either/or, chocolate or vanilla world; people have demanded and are getting a multitude of choices.	68.8	4.56

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Table 2

"Megatrends" Comparative Ratings

	PROBABILITY			IMPACT		
	ASTD	ABSEL	M.U.	ASTD	ABSEL	M.U.
Information [1,2]	82.6	77.4	67.6	5.58	5.23	5.18
High Touch [1,2]	66.9	63.6	54.0	4.39	4.15	3.70
Global Economy [1]	72.3	67.9	60.2	4.39	4.38	4.23
Long Term [2]	53.2	49.7	44.3	4.44	3.54	3.74
Decentralization [1]	58.5	48.0	43.9	4.24	3.91	3.62
Self-Reliance [1,2]	61.3	50.8	40.2	4.34	3.37	3.26
Greater Voice	61.0	58.8	52.8	4.48	4.03	4.04
Networking [1,2]	62.7	59.1	44.2	4.52	4.59	3.84
North-South [2]	58.7	67.7	58.7	3.50	3.68	4.56
Choices [1,2]	80.0	73.7	52.6	5.06	4.86	3.76

[1] Significant Differences (<.10) exist among groups for Probability ratings.

[2] Significant Differences (<.10) exist among groups for Impact ratings.

The probability ratings can easily be compared because of the similarity of the task. Each group was instructed to estimate the probability of the trend occurring, using a scale of 0 to 100%. This estimate was not based on the environment of the specific group. The impact analysis was specific, however, to the group being surveyed. The ASTD group was estimating the impact of the trend on the field of training and development; the ABSEL group was estimating the impact on simulation and experiential learning; and the Marquette University group was estimating the impact on teaching in business administration (in a particular university setting). The impact ratings used a six point scale:

1 = Low impact, narrow focus
2 = Low impact, broad focus
3 = Average impact, narrow focus
4 = Average impact, broad focus
5 = High impact, narrow focus
6 = High impact, broad focus

The data demonstrate both agreement and disagreement, for each of the ten "Megatrends", on both the probability and impact ratings. A detailed summary for each "Megatrend" is presented in Exhibits 1 to 10. The focus is on an interpretation of the specific impacts identified. Additional statistical information, means, ranges, and standard deviations, are also presented.

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Megatrend #1

WE ARE IN A "MEGASHIFT" FROM AN INDUSTRIAL TO AN INFORMATION BASED SOCIETY.

Probability of Occurrence	Degree of Impact
Mean: 75.9	Mean: 5.33
Range: 30-100	Range: 4-6
Std. Dev.: 16.19	Std. Dev.: .71

IMPACTS

Training

More computer assisted training and self-directed learning.

Need to train everyone how to use a computer, computer literacy.

More emphasis on "broad-based" or "gray area" training; less "either-or" and "yes-no" training.

How to train "information" managers and a work force where employees are more knowledgeable than managers.

Higher education professionals will need even more to be "resource" specialists.

Need for high tech training. Need for basic communication skills, speaking and writing.

Training focusing on data, information, decision-making, and planning.

More computer-based training for adult education and retraining.

Higher Education

Expand breadth of simulations to include or serve a broader set of disciplines like Political Science and Public Administration.

More use of computers for games in courses and to analyze data gathered in courses and to give feedback to students on their performance.

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Megatrend #2

FOR EVERY HIGH-TECHNOLOGY ACTION, THERE IS A HIGH-TOUCH REACTION OR THE TECHNOLOGY WILL BE REJECTED.

Probability of Occurrence	Degree of Impact
Mean: 61.5	Mean: 4.08
Range: 10-90	Range: 1-6
Std. Dev.: 19.47	Std. Dev.: 1.24

IMPACTS

Training

There will be an increased need to emphasize human relations factors in the work force.

Greater need for human resource management and interpersonal skills training.

More participative interactive training sessions; less tolerance for lecture "how to."

The need to develop programs on dealing with change to accompany changes in technology.

Increased need for human relations training to compensate for increased pressures between individuals.

Help others change values and beliefs toward high-technology, gaining acceptance of new learning delivery systems.

Emphasis on "quality of worklife"; organization deve programs.

Higher Education

Demand for more interpersonal competence.

Qualitative approaches balancing out quantitative emphasis.

Incorporation of personal development as an objective in more learning exercises.

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Megatrend #3

OUR ECONOMY IS BECOMING PART OF A GLOBAL STRUCTURE, MOVING AWAY FROM ISOLATION AND NATIONAL SELF-SUFFICIENCY. AS A RESULT, WE WILL NO LONGER BE THE WORLD'S DOMINANT FORCE.

Probability of Occurrence	Degree of Impact
Mean: 66.8	Mean: 4.33
Range: 20-100	Range: 1-6
Std. Dev.: 21.38	Std. Dev.: 1.37

IMPACTS

Training

Cultural training and language skill development will be important.

More integration of thoughts and other cultures which will definitely impact on values and systems.

More multi-lingual training required; more employees will have to be multi-lingual.

Developing training programs and interventions that will strengthen people's ability to think in a larger (global) framework.

Cross-cultural training will be vital. We'll all have to learn to overcome our prejudices and learn to focus in the practical issues of humanism and goal orientation.

Global sharing of training skills and techniques. Americans are "shocked" to learn the degree to which our philosophies and approaches are culture bound.

Higher Education

Activities need to be designed so that students are exposed to a multi-cultural dimension.

More emphasis on material having an international emphasis.

A greater need for a specialized type of information training.

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Megatrend #4

U.S. CORPORATE MANAGERS ARE BEGINNING TO THINK ABOUT THE LONG TERM RATHER THAN THE NEXT QUARTER.

Probability of Occurrence	Degree of Impact
Mean: 49.1	Mean: 3.91
Range: 0-100	Range: 1-6
Std. Dev.: 23.45	Std. Dev.: 1.40

IMPACTS

Training

Inclusion of Higher education in initial corporate planning.

Trainers will need to know more about the use of trends, conducting environmental scans, futuring, etc.

No change -- unfortunately we'll still be a voice crying in the wilderness.

"Management training" and new economic structures are needed to make it worthwhile to commit resources beyond one or two quarters.

Higher Education

Long term exercises, extending beyond the traditional semester.

Courses that stress strategic long range planning.

Go to more long term thinking and structure simulations and classes longer than single semesters.

Could lead to more complete and more realistic approaches to thinking and extensive use of simulations.

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Megatrend #5

OUR CENTRALIZED STRUCTURES ARE CRUMBLING. WE ARE DECENTRALIZING GROWING STRONGER FROM THE BOTTOM UP.

Probability of Occurrence	Degree of Impact
Mean: 50.1	Mean: 3.92
Range: 10-100	Range: 1-6
Std. Dev.: 21.10	Std. Dev.: 1.26

IMPACTS

Training

Greater need for management skills development, especially in areas of group dynamics and participative approaches.

The focus of an organization on greater community and state involvement in order to effectively lobby for favorable local laws. This means more effective public speaking skills for managers who represent their organization in the community.

Self initiative in training, career development.

Need to develop new skills and competencies to successfully function in a decentralized organization. Need to examine how to help employees learn new behaviors and norms that come from structural change.

Training would become more diversified and probably conducted more at the request of individuals and work group leaders instead of management.

Greater involvement and participation in local concerns; increased public and community relations responsibilities.

Higher Education

We must educate our students to be change agents, ready to accept a dynamic environment.

More stress on individual/interpersonal problems in coping with change.

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Megatrend #6

WE ARE RECLAIMING OUR TRADITIONAL SENSE OF SELF-RELIANCE, AFTER FOUR DECADES OF LOOKING TO INSTITUTIONS FOR HELP.

Probability of Occurrence	Degree of Impact
Mean: 50.8	Mean: 3.66
Range: 20-100	Range: 2-6
Std. Dev.: 22.80	Std. Dev.: 1.27

IMPACTS

Training

Social service agencies will need more training to cope with self-sufficiency.

Teaching others to accept individual responsibility.

Trainers will trend away from behavioral orientation toward more humanistic orientation.

More emphasis on self-directed learning.

More continuing education; health and wellness have become part of the "educational industry" rather than the health industry.

Higher education will probably have to "fill in" all of the educational gaps these poor kids will have.

Higher Education

Meaningful decision-making; when do you know you have enough information to make a decision -- related to the degree of self-reliance sought.

Move toward individual rather than group analysis.

Need to teach participative skills, responsibilities, and commitment.

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Megatrend #7

CITIZENS, WORKERS, AND CONSUMERS ARE DEMANDING AND GETTING A GREATER VOICE IN GOVERNMENT, BUSINESS, AND THE MARKETPLACE.

Probability of Occurrence	Degree of Impact
Mean: 57.5	Mean: 4.30
Range: 10-100	Range: 1-6
Std. Dev.: 23.24	Std. Dev.: 1.53

IMPACTS

Training

More input and monitoring from outside the organization of what higher education programs are offered.

Organizations are finding themselves coping with greater public demands and media exposure.

Greater rejection of poorly planned and executed training.

This has tremendous impact for communication/interpersonal skills training. If people want a "voice" they need to know how to use it.

Greater demand for training in leadership skills, how to gain and maintain power, negotiation skills, etc.

Creates a greater diversity of education and topics. Our schools are not putting out trainers either in numbers or capabilities to handle this. Many universities look at HRD and Education as lower status departments.

Higher Education

Greater emphasis on social impact of decisions.

Simulations about social issues and political activism.

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Megatrend #8

WE ARE MOVING FROM HIERARCHIES TO NETWORKING,
THE COMPUTER IS SMASHING THE PYRAMID.

Probability of Occurrence	Degree of Impact
Mean: 55.3	Mean: 4.32
Range: 10-100	Range: 1-6
Std. Dev.: 23.41	Std. Dev.: 1.44

IMPACTS

Training

More emphasis on how to work with people instead of for them. Less training on the rules and more on dealing with people.

Computer literacy will be imperative and the older workers will need help with skill levels and acceptance.

This is particularly true in job hunting skills, career development, and upward mobility training. Support groups are vital to development and we need to learn to use them more through training.

Personal networking skill training needs to be offered to the working class.

Need to train people in collaborative approaches to working and living, especially with increased isolation due to computers.

Higher Education

Teach how to design and understand networks! Develop networking competencies.

Information monitor g skills must be build into teaching materials.

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Megatrend #9

THE NORTH-SOUTH SHIFT IN THE UNITED STATES IS REAL AND IRREVERSIBLE FOR THE FORESEEABLE FUTURE.

Probability of Occurrence	Degree of Impact
Mean: 61.7	Mean: 3.91
Range: 0-100	Range: 1-6
Std. Dev.: 26.55	Std. Dev.: 1.50

IMPACTS

Training

Northern areas must learn to adapt to this trend; use of automated equipment and facilities.

Don't agree -- Northeast is still the mecca for education.

Those moving south must be oriented to a specific culture where many stereotypic biases are not true but where traditional values are still upheld. A different kind of cross cultural training is needed.

Increased demand to community and cultural education.

Greater labor competition, more retraining, break up of present dominant industries.

Higher Education

Emphasis on radical change based on crisis. Structural conflict and contradiction might become key concepts for understanding change, through different disciplines.

Input energy, relocation, labor force characteristics, consumer movement, state regulations into decision-making.

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Megatrend #10

WE NO LONGER LIVE IN AN EITHER/OR, CHOCOLATE-OR-VANILLA WORLD, PEOPLE HAVE DEMANDED AND ARE GETTING A MULTITUDE OF CHOICES.

Probability of Occurrence	Degree of Impact
Mean: 68.8	Mean: 4.56
Range: 20-100	Range: 1-6
Std. Dev.: 19.49	Std. Dev.: 1.25

IMPACTS

Training

Strategy -- teaching people to THINK!

Demands for higher education programs to be based on individual needs rather than larger group needs, more specific tailoring of programs.

Many individuals are not sophisticated about making choices. They will need help with problem solving and decision making skills.

Need for greater availability of specifically tailored instruction. Greater use of computer based instruction.

Development of a variety of training techniques and styles to meet individual needs of trainees.

Employees will choose their learning from a "cafeteria" rather than a set curriculum.

Higher Education

Teaching people how to deal with ambiguity.

Go into cafeteria style grading and experiment more with optional classroom activities that meet different needs of different students.

Need to teach more complex decision-making methods, including highly subjective or personal critieria.

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While there is widespread disagreement about some of the "Megatrends", both in terms of the probability of their occurrence and their impact, there is also substantial support for actions which must occur for the field of higher education to continue taking an active role in human development.

Professionals in higher education must continue to take a strong role in the action planning that is associated with the assessment of impacts. Directions are not enough; action planning and results will be the real determinants of the profession's ability to deal with the future. Professionals in higher education need to develop two of the key concepts from **In Search of Excellence** [2]. Communication about issues must be increased and a "bias for action" must be developed that causes the profession to take steps that deal directly with those "Megatrends" that are going to impact significantly on college teaching.

Bias for Action

The "bias for action," follows the analysis of their probability and impact. From the individual responses, there are proposed actions which would likely receive substantial support from the profession. Individual actions are indicated for the "Megatrends." However, there are four strong issues that seem common to this entire project.

Action Call: There is a substantial need for new educational programs. Despite the recognized volume of educational programs, there were widespread demands for new programs throughout the "Megatrend" analysis. For every trend, individual responses were recorded that asked for and identified specific programs that are not currently available. Program needs were identified in cultural issues, communication skills, computer literacy, human relations, planning, decision-making, career development, and leadership skills. These programs will have new content, new approaches, and be delivered using the new technologies.

Action Call: There is a major need for improved communication about what education does and how to do it. The wealth of educational programs currently available makes the first "action call" hard to accept. The number of programs available for some of these topics is substantial. Despite this reality, there is substantial support among the survey respondents that these programs will not meet the demands of the future. Alternatively, there is some evidence that professionals face difficult decisions in identifying the appropriate program when faced with the "multitude of choices."

Action Call: There is a need for more programs that effectively use the principles of self-directed learning and self-choice

about what is learned. There was a substantial reaction throughout the research that there will be more focus on identification of individual learning needs and individualized approaches, often computer-based, to learning. While the term is common in the compensation area, the idea of "cafeteria" education may be new, and frightening, to many. It will require a radically new approach to education in some institutions.

Action Call: There is a need for new teaching methods. This is a surprising outcome of the research. An assessment of teaching techniques shows there are teaching approaches for almost any subject and any audience. Yet the respondents in this research seem to be generally concerned about new ways of presenting content. There was substantial concern over the ability of the computer to become a major delivery vehicle for higher education. The problems of successful computer-assisted instruction and the continuing need for personal, instructor contact appear to be a call for new approaches. While ideas were generated for specific actions in other areas, this call for action appears to be a hope for some yet-to-be discovered teaching strategy.

SUMMARY

The directions for higher education and college teaching identified above are meant to be clearly one interpretation of the results of this research project. In reality, it is the organization itself and the individual professionals which will identify and decide, by their actions, the directions the field of higher education will take as a result of the "Megatrends." The materials presented here are an attempt to increase the amount of information available to individuals facing these trends and focus on the "bias for action" that is necessary to continue leadership in the field of higher education.

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Author's Note: Additional results from the individual surveys, including a complete set a statistical data, the analysis of variance, score distributions, etc., are available from the author upon request. Copies of all comments are also available.

A BRIGHT FUTURE FOR INSTRUCTIONAL TELEVISION THROUGH TECHNOLOGY

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A Bright Future for Instructional Television Through Technology

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Introduction

For the past 40 years educators have been investigating the use of instructional television for improving the efficiency of the educational process. To date very little of the potential offered by the electronic media has been realized in higher education. Many times in the past predictions were that a large percentage of college classes would be using television. Even with the major innovations, such as videotape recorders, instructional television has not enjoyed large acceptance.

We have been using television in some of our classes for the past three years, and we have been investigating some unique aspects of the medium. This is a report on some of our observations and predictions for instructional television.

Television in Classes

Our delving into the instructional television was for the purpose of increasing the efficiency of education and for freeing students from the time and place constraints imposed upon them. We initiated our studies at a time when conservation of energy was a goal. We originally tried to imagine the future in higher education with technology being used to alleviate some of the constraints. We envisioned students not constrained to attend classes every MWF at a predetermined time, but receiving instruction from videotapes using a videotape recorder-player at home. The students could come to campus for tests or individual instruction when appropriate. We also envisioned that many students would communicate with the instructor by microcomputer.

The first question that arose was, "Is instruction by television as effective as instruction by live lecture?" We found that this question was not addressed very well in the literature. Since we wanted some experience using television we decided to try to address this question while gaining instructional television experience. Our approach to using televised instruction was to televise regular lectures in the classroom. This seemed appropriate because one of the disadvantages often listed for instructional television was the high cost, in time and money, for production.

Three entire courses were videotaped in the classroom. To evaluate the effectiveness of learning by televised lecture compared with live lecture, each class was randomly divided into two groups. While the lecture was given to one group live, and being videotaped, it was televised in an adjacent room to the second group. Each group received exactly the same lecture, the only difference being the medium of presentation, live or televised.

During the semester the groups were given exactly the same tests at the same time. There was no significant difference between the learning of the groups as measured by the tests. To insure that the groups were similar in learning ability, the overall grade-point-averages and the SAT scores were compared. In each class the groups were similar by these standards.

The results from one of these classes, Engineering Economy is shown in Figure 1. The results were very similar in the other classes tested this way. The conclusion was that in many classes students can learn as well by televised instruction as by live instruction. Significantly, this televised insturction can be accomplished through inexpensively produced tapes from a regular lecture.

During our studies the videotapes were placed in the library to be available for student use after the class. We maintained records of the use of these videotapes, and discovered that the students will use videotapes if they are

available. A graph of the useage of these tapes between exams is shown in Figure 2.

On the basis of the positive results obtained in these studies, we propose that televised instruction can be used effectively in several ways:

1) Videotaped courses can be televised to a classroom at several different times for large or multiple section classes.

2) Entire courses can be put on videtape and sold to the students at registration. An entire course of 45 hours can be put on 6 tapes at a cost to the student of approximately $5 per tape. The student can have a videotape recorder at home at a cost of approximately $300. Over a 4 year period, these costs amount to about one extra book per semester.

3) Videotaped instruction for laboratories can be a tremendous improvement for demonstration of instrumentation or principles.

4) As a minimum, faculty members can videotape lectures for televising when he cannot be in class.

Time-Compressed Videotapes

Recent advances in video and audio technology have provided new opportunities for exploiting the potential of instructional television. Specifically, hardware now available is capable of providing broadcast quality, time-compressed videotapes suitable for use on regular videoplayers. This technology captured our interst three years ago, and we have studied its use in the classroom.

We had several sets of lectures (5 to 6 lectures from a single class) time-compressed by 30 per cent and one set of 5 lectures compressed by 40 per cent. We have performed several experiments for comparing learning from regular-speed videotapes with that from the time-compressed videotapes. In all of

our comparisons, experimental procedure was established wherein the only variable was the method of presentation of the lecture.

In three courses, the learning via televised lectures at regular speed was compared with the learning via 30 per cent time-compressed televised lectures. During these comparisons the class was randomly divided into two sections. One section saw regular-speed lectures and the other group saw time-compressed lectures. At the end of each lecture, each group was administered the same short test. At the end of a set of 5 or 6 lectures each group was administered an exam covering the material in the 5 or 6 lectures. A typical comparison of the results is shown in Figure 3. It was our conclusion after the comparisons that students in some classes can learn as well from 30 per cent time-compressed televised lectures as they can from regular-speed televised lectures. Our comparisons using the 40 per cent time-compressed lectures indicate that this speed is too fast for many of the students.

We learned much from our studies with time-compressed videotapes, but we raised as many questions as we answered. We know students can learn well from time-compressed television. Efficiency of learning can be increased, possibly even total learning can be increased, because of the increase in the students attention to the lecture. It has become obvious that using time-compressed television efficiently is a complex undertaking. The compression rate must vary with many factors such as the material being presented, the presenter, and the learner. Using videotapes time-compressed at a specific rate is feasible in the classroom. However, inexpensive variable-speed tape players must be available before time-compressed instructional television will enjoy widespread use. This technology is iminent. In fact, at UTEP we have adapted available hardware for this use already.

Improved Hardware for Instructional Television

To effectively use time-compressed videotapes, a student must be able to choose the speed of the presentation. Inexpensive variable-speed tape players of good quality have been available for several years. For the past two years, inexpensive variable-speed videotape players have been commercially available. These players have good quality video, but the audio does not work properly when the speed is changed from regular speed. During the past several months we have modified a variable-speed audiotape player to work with the variable-speed videotape player. Therefore, a regular videotape can be used at whatever speed desired. This technology will most surely be commercially available in the near future.

Interactive learning with a television or a computer is another very important concept that is developing. For a time it seemed that videodiscs would be the hardware used for interactive learning. But the high initial costs seem to have precluded their growth and wide spread use.

Interactive learning from videotapes has not been possible because of the inability to rewind easily to a chosen position on the tape. The new variable-speed videotape players contain hardware which has overcome this shortcoming. Even though they are not as fast as videodiscs, videotapes can now be used effectively for interactive learning.

Conclusion

Even though instructional television has not grown as much as was expected by many, new developments in the technology of television make the possibilities even more interesting. One of the largest obstacles of instructional television is the present system of education. The rigid system under which most of us teach makes it difficult to incorporate instructional television into the teaching-learning

process. Instructional television will undoubtedly have a brighter future in environments that encourage innovation and improvement in the process.

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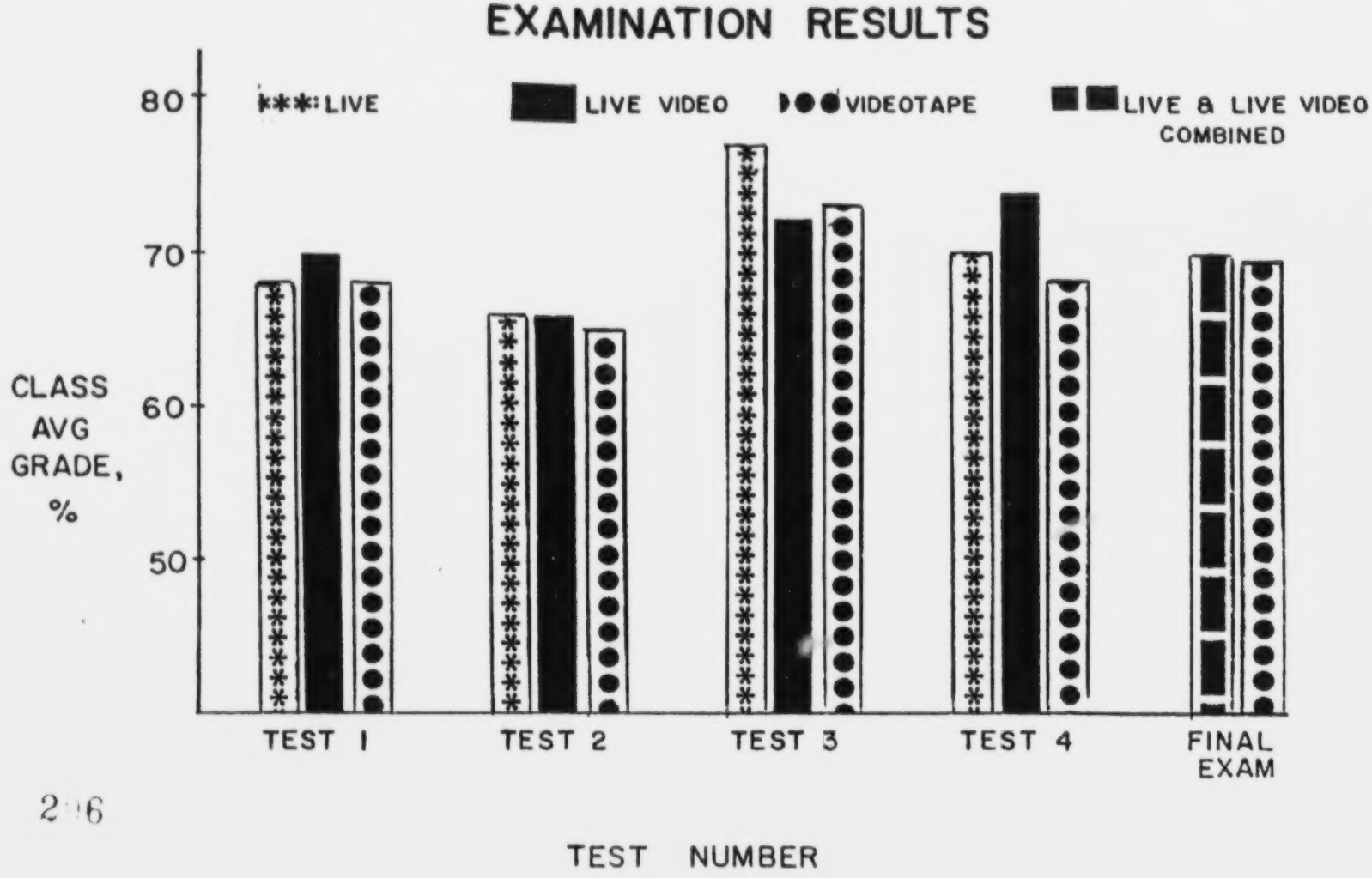

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Figure 1. Comparison of Learning from Live Lecture and Televised Lecture for Engineering Economy

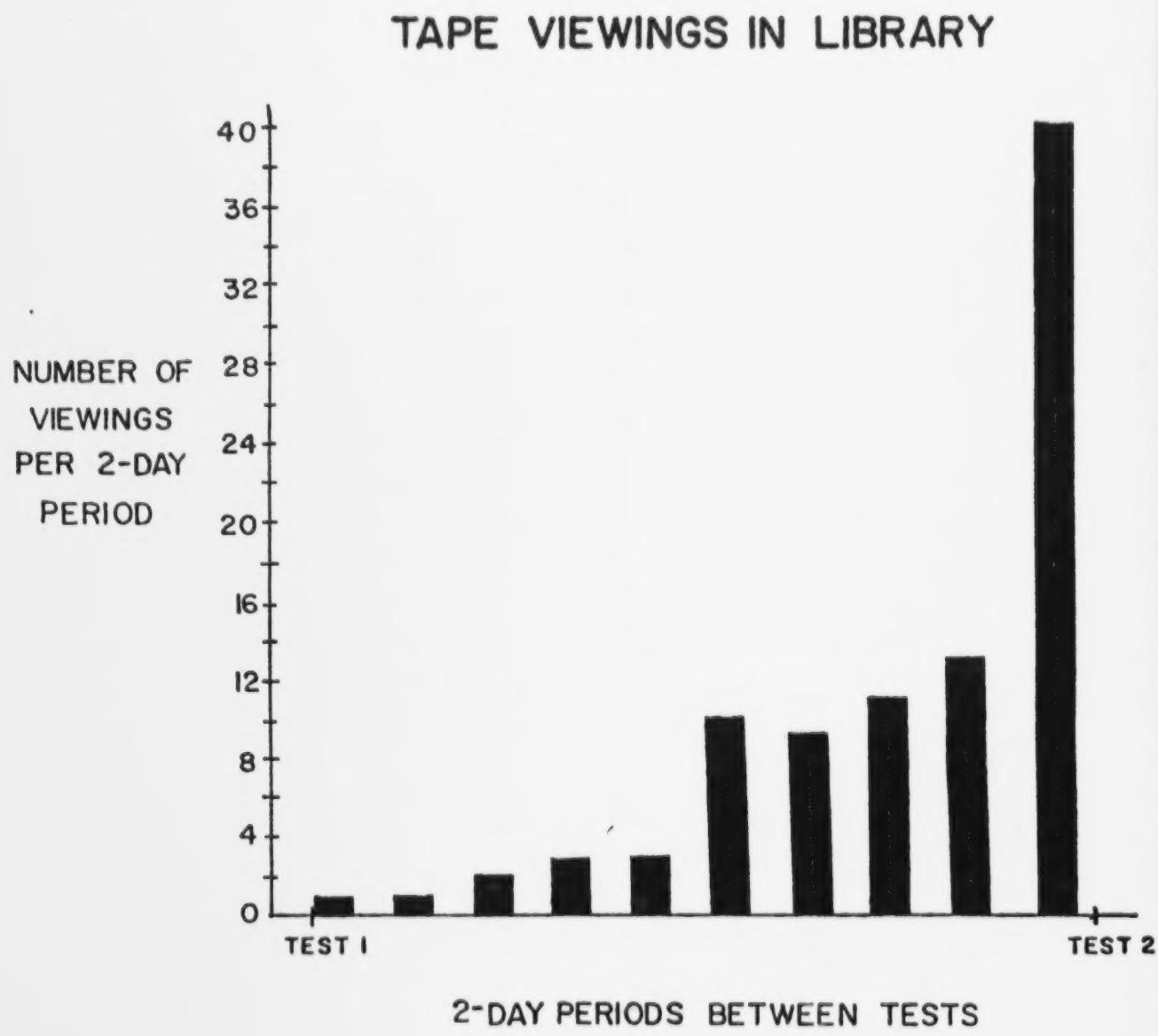

Figure 2. Videotape use in Library for Engineering Economy

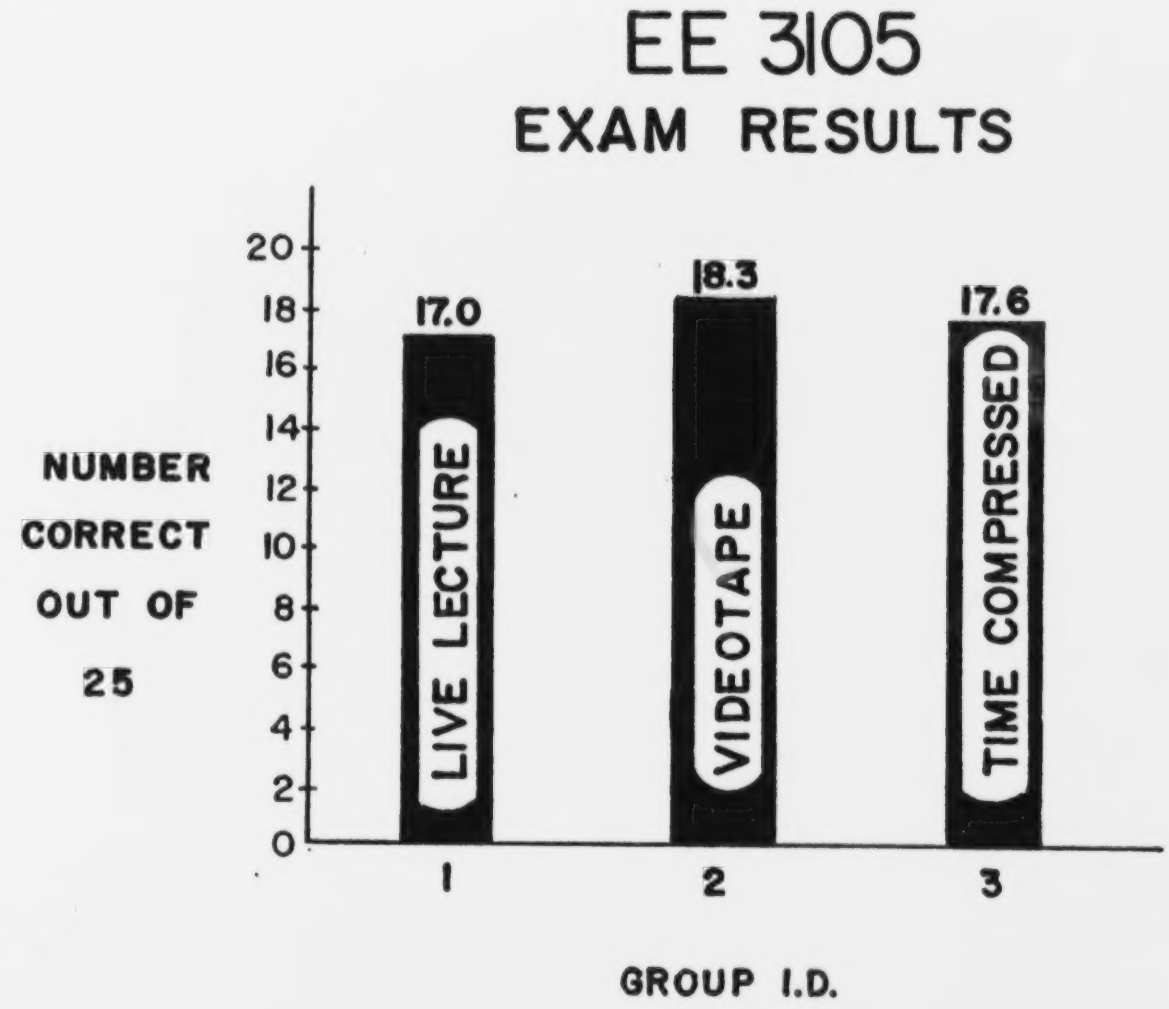

Figure 3. Comparison of Learning from Live Lecture, Televised Lecture, and Time-Compressed Televised Lecture for Introduction to Electrical Engineering

CAN COMPUTER ATTITUDES INHIBIT TEACHING TO POTENTIAL?

by

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Can Computer Attitudes Inhibit Teaching to Potential?

Educators who contemplate the challenge of preparing students for the future are presented with a dilemma. A design for "teaching to potential" must surely include training to permit teachers to function in the computer-intensive culture of the near future. Yet, attitudes developed within the value structure of a traditional society may prohibit full utilization of these new teaching tools:

> (Mrs. Boyden's) reputation as a teacher of chemistry has stood for decades among the highest in secondary education. ...Her gray-white hair is swept high on her head. She often wears a pearl chocker, a silver bracelet, a gold watch, a silver pin...On the blackboard she has written, "The sins we commit two by two, we pay for one by one." The next day: "There are few concepts so difficult that they do not yield to the repeated attack of the ordinary mind." She plays games with the boys (of the academy), giving them gradeless quizzes, drawing them out as if they were around a dinner table. "Victor," she said to one, years ago, "when will you stop trying to remember and start trying to think?" Victor Butterfield is the president of Wesleyan University, and that is his most highly valued story about his own education. (pp. 428-431)
>
> John McPhee
> The Headmaster: Frank L. Boyden, of Deerfield

This description of Mrs. Boyden as a teacher seems to epitomize the mental vision many of us have of "teaching to potential." It is of a teacher, often employing the Socratic method of questions and answers, who is able to stretch the minds of students by forcing them to think, not just remember. This model of exemplary teaching represents a traditional society.

The goals of mind-stretching and helping students to progress from rote/recall types of learning to higher thinking are as valid today as they were yesterday. Good teachers, such as Mrs. Boyden, are still the heart of

good schools. Yet, ours is no longer a traditional society, but a post-industrial information-based high-tech culture. Communities are pushing education to extend and elaborate the definition of good teaching to include the use of the products of our technological society, particularly computers, to help students to become better thinkers. School districts and institutions of higher education have rushed to embrace this new technology.

Hunter, Dearborn, and Snyder (1983) have reported a variety of activities in a program in two suburban districts near Washington, D.C. which integrated computer usage in a K-8 curriculum.

> ...kindergartners spent class time last year on testing and debugging procedures that controlled their imaginary robot friend, ZEEP. ... Fourth graders developed their own procedures for learning fractions by computer. Sixth graders used computer programs to help analyze the results of their science programs. They used word processors to experiment with and improve their compositions...(p. 115)

These activities exemplify what many computer advocates consider to be the strength of the computer--"its ability to help children think--to help them understand complicated concepts by placing them in a context that is relevant to children." (Papert, 1982, p. 86). If so, then this may be the model for "teaching to potential" in the 1980's and the future.

Can this goal be realized? Or are there barriers which may block the promise of incorporating the full power of computers and technology into education and teaching? The purpose of this paper is to examine attitudes about computers and technology which could undermine efforts to improve teaching through implementation of comprehensive programs of educational computing.

Computer Attitudes

Attitudes about computers have been neither well-defined, nor well researched. While computers have been in use in schools and universities since the late 50's and early 60's, their use was confined to a small segment of

the educational community. Now the enormous teaching and learning potential of the computer has become available to a much broader spectrum of society because of the relatively low cost and accessibility of the microcomputer in contrast with the large mainframe computer.

The explosive nature of this development has resulted in computer attitudes which range from wild enthusiasm to highly negative rejection (with some degrees of caution, confusion, and skepticism in between). Research monographs, journal articles, and reports in the press have dealt with student attitudes, teacher attitudes, and attitudes in the general society about computers.

Enjoyment, anxiety, efficacy, and education computer support. In a broad-based assessment of computer awareness and literacy of eighth and eleventh-grade students in Minnesota, Anderson, Klassen, Krohn, and Smith-Cunnien (1982) included an affective component. This component measured computer attitudes in four dimensions:

> enjoyment...(degree to which a student enjoys working with computers); anxiety....(level of anxiety or stress associated with using computers); efficacy...(sense of confidence in ability to use computers); and education computer support... (degree to which a student feels positively about computers in education) (p.39).

Resistance/receptiveness to educational innovation. Certain attitudes of teacher resistance to the use of microcomputers in teaching have their roots in past experiences with educational innovations. For teachers and administrators attitudes of opposition to computers may not simply be inertia nor a fear of the unknown, but due to historical precedent.

> "The wariness of educators to embrace the new technology of the personal computer lies in the broken promises of earlier technological innovations--computer-aided instruction in the 60's, programmed learning by teaching machines, educational television...None of these became integrated into curriculum, and while there may have been some partial successes, these innovations failed to revolutionize education as their advocates promised." (S.D. Smith and W.D. Smith, 1984, p. 28).

Technophobia. "Technophobia" has been characterized by Porter (1984) as:

> ...the underside of a humanistic preoccupation with the personal, the aesthetic, and the spiritual: a fear of and disdain for the "blind monster" technology and all its works and pomp...

Porter attributes this hostility to what machines represent and negative reactions to the computer to the fact that computers perform quasi-personal functions in society generally. For many teachers, this depersonalization is a real threat. In Philip Jackson's "The Way Teachers Think" teachers' thinking is characterized as "a romantic view of the world" (p. 36). He described this view as including a focus on individuals, intuitive thought, a tendency toward sentimentality, with a resistance to generalizations, abstractions and analytic thought. Jackson emphasized: "Teachers are constantly thinking and talking and acting in terms of people, not just people in the abstract, but particular people" (p. 28).

Computer Anxiety. The term "computer anxiety" has been used with a wide variety of connotations and implications. In fact, one might find that it has been used in much the same amorphous way that the term "computer literacy" has--with particular meanings for different users of the term, and no generally agreed upon definition. While some might consider the term "computer anxiety" to be synonymous with "technophobia," the attitudes which are associated with "computer anxiety" in the framework of this paper are those associated with mathematical and technical competence. As Winkle and Mathews (1982) have said, "Feelings of anxiety when confronting anything 'mathematical' readily spill over to computers" (p. 315).

Sex-role stereotyping. Closely allied to computer anxiety is sex-role stereotyping as a computer attitude. This attitude that computers are a male domain, and that computers are too complex for females is described by Gilliland (1984):

> ...computer arcades are dark, noisy places which attract boys and men; high school computer science courses reflect high male enrollment figures; parents fill after-school computer classes and computer camps with their sons, not their daughters. The actions of parents and society combine to demonstrate to girls that computers are not for them (p. 42).

Age-related attitudes: traditional society attitudes vs. computer culture attitudes. The positive attitudes which Anderson et al. (1982) characterized as "educational computer support" are not only present in adult society (as well as among the students and young people), but have been responsible for decision-makers embracing the new technology with investments in hardware and software and the mandating of teacher and pupil training in computer literacy. Yet, there is a distinction between attitudes toward computers held by younger people to whom this technology seems commonplace, and those held by many older people whose education and training occurred before the advent of educational computing.

Attitudes of "computer culture" grow from the fact that today's students accept computers as being part of everyday life. Computer games, personal computers in the home, television advertising, television programs and movies in which the heroes are young people with computer skills...all combine to give students a sense of being well-acquainted with computers.

In contrast with this attitude of considering the computer commonplace, traditional attitudes are associated with teachers and other adults who were educated in a society where computers were safely relegated to large air-conditioned rooms run by technicians. These individuals do not have the feeling of ease with computers that many younger people seem to have. Widmer and Parker, 1983, refer to the age-difference in attitudes: "...adult uneasiness is often compounded by witnessing children who undauntedly take to the computer as they did to T.V." (p. 23). In other words, fears of ineptitude, and feelings of tentativeness about computers may be exacerbated in teachers who see the competencies of their students rapidly surpass their own skills in computer usage.

Computer Attitude Related Research

Research on attitudes and feelings about computers, particularly teacher attitudes, is scarce and fragmentary. Much of what has been written about

computer attitudes is the nature of opinion, which may or may not be based on experiences and observations. However, there has been research that can be examined from which attitudes can be inferred. For example, research which has documented computer usage can be show to have implications related to computer attitudes.

Computer enjoyment, anxiety, efficacy, and educational computer support. The Minnesota Computer Awareness and Literacy Assessment was administered to a total of 3,615 eighth and eleventh grade students in Minnesota in 1979 (Anderson et al. 1982). These Minnesota students were reported to have moderately high levels of enjoyment of computers, but with some degree of uncertainty concerning their feelings. Eighth graders seemed to enjoy working with computers slightly more than eleventh graders. Students at both grade levels expressed little anxiety about working with computers, yet their sense of confidence in working with computers ("efficacy") was not high. Researchers found that students were generally positive and supportive toward the use of computers in education, but with some uncertainty about what educational computing should be. It was reported that students who had had computer courses or with computer experience were significantly (.05 level) more positive in their computer attitudes, but not dramatically different from students who had no exposure to computers.

Resistance/receptiveness to educational innovation. Stevens (1984) has reported the results of three different Computers in Education surveys given in Nebraska in 1979, 1981, and 1982. In the 1979 and 1981 surveys, a large majority of respondents showed receptiveness to the belief that high school students should be computer literate, but few reported themselves able to teach computer literacy. Only 9% of higher education faculty reported this skill.

In the 1982 survey, there were predictions by educators that computers would have a strong influence on curriculum and classroom instruction in the future. Interestingly, teachers did not respond positively about the future of computers

in their own classrooms. Over three-fourths of subjects:

> viewed their methodology as either not being conducive to microcomputers, or they were not sure if microcomputers would blend with their instructional techniques...In other words, educators in this study perceived that computers would strongly influence classroom instruction and curriculum, but not in their classrooms (Stevens, 1982, p. 55).

Sex differences in computer usage. In a study of students in summer computer camps and classes, Miura and Hess (1984) examined sex and socioeconomic status (SES) enrollment differences. They found that males outnumbered females by a percentage of roughly three to one. In addition, they determined that "the disparity between boys and girls increases with age, is greater in advanced than in beginning classes, and is larger for expensive programs" (p. 22). They also found that participants were overwhelmingly Caucasian and predominantly middle and upper income (98%).

In an investigation of the male-dominated culture of computing, Kiessler, Sproul, and Eccles (1983) surveyed video arcade use. The premise of their study was that the culture of computing is controlled by males who "design the video games, write the software, sell the machines and teach the course (with few exceptions)" (p. 42). In a video arcade survey they found that the population was 175 male to 30 female. Some girls were playing the games with groups of girls, most were simply observing boys. None were playing alone. The authors concluded that "Cultural factors and expectations, rather than any inherent disadvantage in capabilities, seem to keep girls out of arcades and away from computers" (p. 48).

A recent survey of 1,242 people by USA TODAY (Manning, 1984) found males the main users of home computers, with adult males accounting for 43% of the use, followed by male children with 27% being the main computer user in their household. Only 15% of female adults were the main computer users of the home, with female children being the least likely to be the major computer user in their families.

Teacher and student computer confidence and sex-typing attitudes. In a study conducted in a southwestern community known for academic excellence (S.D. Smith, 1984) examined computer confidence and sex-typing attitudes in relationship to sex, grade level, and teacher influence. While not unique in the United States, the school district in which the study was conducted is certainly advanced in its implementation of computer literacy in comparison with most school systems. A curriculum designed for computer instruction across grade levels has been in place for more than a year. All students throughout the grades are required to take computer literacy courses. In the survey only 10% of the teachers responding indicated that they had not had any introduction to computer literacy or awareness.

A random sample of students from levels 1-12 were tested, together with all teachers. Comparisons were made by grade level (students' grade level and level taught by the teacher), sex, and teachers vs. students. Elementary level respondents were found to be significantly more confident that junior high or high school level, and students were found to have significantly more confident attitudes that teachers did. Interestingly, there were not significant differences between males and females in their attitudes of "efficacy" or confident in ability to use computers.

On the sex-typing attitude scale there were no significant differences by grade level, nor between teachers and students. All groups showed a high degree of belief in equality of the sexes in computer and science abilities and careers. However, there were significant differences between males and females, with females showing a stronger belief in equity. Males showed more of a tendency to beliefs that computer study and careers are better suited to men and boys.

Perhaps the most interesting finding of the study was in the results of a classic regression analysis. Teacher confidence scores were significantly and

negatively related to student confidence scores. This seemed to indicate that as students' confidence went up with more exposure to computer classes, apparently teachers' confidence went down. Despite teachers having had introductory courses, apparently their feelings of confidence lessened as they saw their students becoming more skillful and competent in their use of computers.

Technophobia and computer anxiety. These attitudes of fear of depersonalization, and anxieties that are linked to concerns about math and science may be the most frequently named as "computer attitudes." Yet, with the exception of the Minnesota computer literacy study, there appears to be a lack of actual research about these attitudes. Math anxiety research has been cited to make a case for females transferring math fears to computers (Winkle and Mathews, 1982). Research is needed in this area to determine the nature of these attitudes.

Conclusions

The tantalizing promise of computers and the new technology to enhance the teaching process is a long way from being realized. The challenge and complexity of developing curricula, choosing appropriate hardware and software, and training teachers and students have been widely acknowledged in educational and community circles. Yet, all the efforts which have been made may be to no avail unless decision makers realize the importance of teachers' attitudes regarding computers.

It is generally agreed that attitudes influence the way that people think, feel, perceive, and behave toward certain objects. The attitudes which teachers hold about computers may determine the future of educational computing. Attitudes of resistance to the implementation of computers may have their origins in past experiences with educational innovations, in technophobia, computer anxiety, sex-role stereotyping, or age-related experiences. Whatever their roots, negative computer attitudes may result in teachers who acknowledge that computers will influence education in the future, but not in their classrooms (Stevens, 1984).

In a survey of school districts around the metropolitan area of New York City, Fiske (1984) reported that principals said that teacher resistance to training in computers was their major problem.

The existence of sex-role stereotyping attitudes regarding computers seems well-documented in research of computer usage. Yet, when the opportunity of computer classes was provided to both teachers and students in a southwestern community (S.D. Smith, 1984) there were no significant differences between males and females in attitudes of confidence about computer skills and ability. Equity of access to computers may be one way to overcome the negative effects of sex-typing attitudes. "Technophobia" and "computer anxiety" may yield, as well, to well planned programs provided for all students and teachers.

Generational differences between teachers and students should be acknowledged by those who are responsible for teacher training in computers. The ease with which many students acquire computer skills may be intimidating to teachers, as has been suggested in the previously cited research. Horror stories of computer inservice sessions for teachers conducted by "experts" abound. Perhaps the solution would be to have teachers and students sharing the learning process together. In their study of implementation of computer literacy, Hunter, et al. (1983) stated that teachers turned to students for ideas and information about computer related activities.

The hope that computers and technology can become a part of "teaching to potential" should be no less bright with the acknowledgment that there are negative attitudes among teachers about computers. Positive attitudes of enjoyment, educational computer support, and confidence in computer skills and ability seem to grow with opportunities to acquire computer 'iteracy. There are many challenges on the road to becoming a computer literate educational community.

There is a need for more research to substantiate the existence of the

computer attitudes which have been suggested, and to examine their relationship to teacher and student behavior. Research on teaching in higher education has not dealt with computer attitudes in university-level teaching. However, the definitions of computer attitudes and the reports of research related to computer attitudes which are examined in this paper have strong implications for university teaching. All the attitudes addressed in this paper (enjoyment, efficacy, educational computer support, technophobia, computer anxiety, sex-role stereotyping, age-related attitudes, and resistance to educational innovation) certainly exist at the university level. Not only those engaged in teacher education, but faculty in all areas of university teaching must be concerned with these computer attitudes if the promise of educational technology is to be realized, and "teaching to potential" will be an attainable goal.

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INSTRUCTIONAL TELEVISION FIXED SERVICE: THE CHALLENGE TO EDUCATIONAL INSTITUTIONS

by

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The Federal Communications Commission originally set aside twenty-eight channels for operation of Instructional Television Fixed Service (ITFS) systems. Many of the original 82 channel approvals were granted to PBS stations seeking to expand educational programming for colleges and universities, secondary schools, and nonprofit organizations. The new use of the channels (most of which fall in the 2500-2690 megahertz band), was designed to interconnect PBS microwave transmitters into a National Narrowcast Service. Between 1980 and 1983 the F.C.C. opened the channels for other uses, and included provisions for smaller applicants to enter into "lease agreements" with outside commercial interests for excess channel capacity (F.C.C. General Docket No. 80-112).

The Commission's proposal prompted sharp criticism from several nonprofit sectors who suggested the agency had given into commercial interests whose only programming ambitions were to increase pay movies, televised sports, and video games. This issue, still facing the F.C.C. in its approval of low-power licensees, requires determination of an applicant's desire for income versus serving the public's interests.

In the period subsequent to Docket No. 80-112, a number of universities, colleges, and nonprofit groups sought approval of I.T.F.S. operations. Many commercial groups, likewise, saw an inexpensive opportunity to get into the "narrowcast" business, and to compete directly with local cable and subscription television services. A number of the applications received by the F.C.C. included program schedules and financial agreements combining the instructional interests of the proposed licensee with entertainment programming provided by the commercial leasee.

The volume of applications filed on behalf of those wanting low-power

approval was simply more than the F.C.C. could accommodate (4-6,000) by most estimates). While local applicants were supposed to be favored, the list included 150 proposals filed on behalf of Sears, Roebuck, and Company, and over 100 applications from Microband, currently the country's largest low-power television operator.

This paper examines the proposal of an I.T.F.S. facility, specifically that proposed for operation at the University of Colorado at Colorado Springs (UCCS). The reader will be briefed on the issues and decisions facing institutions desiring such a system, from its conception to operation.

The University of Colorado at Colorado Springs is one of three branch campuses of the University of Colorado system, and is located in an area of concentrated high technologies. Because of expanding activities in the electronics, computer science, and aerospace industries of the Pikes Peak Region, there exists a pressing need to provide information and instruction in engineering, business, and the liberal arts. Demand for the live and/or videotaped delivery of telecourses is growing steadily, and in an effort to meet these educational needs, UCCS has applied for approval of four channels on the low-power television bandwidth.

The advent of technology in education is not new. The hardware for low-power television has been successfully utilized, for purposes other than I.T.F.S., for over twenty years. As the demographics of college-student populations change, economic and social forces place the new technologies squarely in the forefront for delivering information.

The Carnegie Commission on Higher Education forecasts that by the year 2000, eighty percent of all off-campus instruction will be delivered by the new information technologies. The number of persons who could benefit from the new I.T.F.S. systems is enormous, and includes:

- Those wanting to meet requirements for lecensure, certification, or post degree credit;
- Those wanting in-service professional upgrading and continuing educational credit;
- Those seeking professional and vocational retraining beyond entry-level preparation;
- Those needing college preparatory skills in basic education, testing, and application procedures;
- Those wanting cultural enrichment in the humanities, arts, and sciences;
- Those wanting public information--general survival knowledge.

Unfortunately, many of the colleges and universities who could well utilize these capabilities cannot afford the allocation of resources necessary for I.T.F.S. operation. In the light of this realization, the F.C.C.'s Docket 80-112 has opened a number of opportunities and an equal number of tough choices regarding financing, programming, and operating such a system.

These choices are often resolved by difficult negotiations between the university's existing media support groups, its administrators, and outside commercial interests. The negotiations begin with the earliest envisioning of the system, and include:

- Constructing and equipping the I.T.F.S. transmission facility;
- Contracting and arranging for payment from outside interests;

- Operating, programming, and budgeting of the system;
- Marketing the telecourse options;
- Copyright considerations and faculty compensation.

Organization of the I.T.F.S. facility offers several options to the educational institution, a few of which follow. The institution may elect to construct, operate, and maintain all origination points, transmission facilities, and on-site receivers. Or it may simply serve as a programming source, leasing time from an outside entity which handles all aspects of transmission and reception maintenance "above the ceiling" of the origination point (e.g., the TAGER system at SMU). Finally, an institution may enter a "consortium" or "networking" agreement, wherein several agencies or institutions operate their own origination and delivery systems, and pool programming and distribution resources to create a network.

In the process of considering a system at UCCS, all three were considered, each offering unique advantages and drawbacks. Initially, the central administration of CU-Boulder began efforts to inter-connect the three university campuses along the front range via microwave. The system called CATECS (Center for Advanced Training in Engineering and Computer Sciences), included capabilities for video courses originating from each campus to be received at the other two campuses, thus serving clients in all areas affected by the inter-connect. Each campus would be capable of originating, transmitting, and receiving classes simultaneously. (Requirements for the system are stated here only conceptually, with a cautionary note to the reader that designing and engineering this type of

system is extremely complex, and well beyond the scope of this discussion).

During discussion of the University-wide inter-connect, UCCS was approached by two outside commercial interests, each wanting to lease excess channel space for entertainment programming. In the negotiations, it was agreed that whichever outside agent UCCS became involved with, that agency would construct and maintain all transmission facilities in return for programming time. In these proposed agreements, the principle disadvantages to the institution included:

- The long term of the lease: ten years initial and ten years renewable;
- Possible public backlash over the program content aired on UCCS channels during non-I.T.F.S. hours (i.e., R- and X-rated movies and features);
- Possible discontinuance of the lease agreement by the leasee, leaving UCCS with I.T.F.S. broadcast commitment, and no operational monies;
- Possible political problems in an outside company competing with a local cable firm on UCCS channels.

Despite efforts on behalf of both parties, no agreement was reached between UCCS and an outside commercial interest. However, from these negotiations, two things became quite clear. First, programming an I.T.F.S. channel for five broadcast days per week would be difficult, but programming four such channels would be nearly impossible on the monies being discussed. Secondly, the interest in UCCS's low-power allocations was very intense from commercial interests, and the necessity for gaining construction approval was immediate. Regardless of whether UCCS entered into agreements with the firms initially contacting the institution, or

with no outside agencies at all, UCCS administrators decided that obtaining the channels was vital.

Arrangements began along the lines of the first organizational option mentioned--proposal of a system on behalf of UCCS solely, and including construction, operation, and maintenance of all origination and transmitting facilities on the UCCS campus. A later compromise involved the Colorado Department of Telecommunications (an agency of the state government), preparing the application in return for tower space to operate its state-owned weather and police radio systems. In this, UCCS had accomplished two objectives: getting its application before the F.C.C., and maintaining relative autonomy over its educational programming and operations. The system proposed contains all of the elements of that being previously considered with the outside commercial interest, and allows for future inter-connection with the CATECS system.

Once the application was proposed to the F.C.C., it became necessary to return again to issues of operation and budgeting. UCCS had lost (immediately at least), one of its only sources of revenues--channel leasing, and now operating the system became UCCS's responsibility once again. Expense estimates vary for construction and equipment ($15-150,000 by central administration and Department of Telecommunication estimates); and upwards of $70,000 for equipment to originate programming.

It seems appropriate to mention a few things here about "programming" and economies of scale in the television industry. For the uninitiated, quality television programming, like quality education of any kind, is expensive. In this instance we are discussing quality programming of the

information-intensive "talking head" variety, with visual support (i.e., on-camera notepad used by the instructor in the same manner as a blackboard). The origination point is not a studio, but a classroom equipped with cameras on remote-controlled pan-and-tilt units. The cameras are positioned to pick up the instructor's writing of notes, diagrams, etc., in an over-the-shoulder shot. This "candid classroom" approach has been used with documented successes in a number of instances, with the best designs incorporating two-way audio capabilities via phone lines from the remote site, and/or slo-scan interactive video set-ups.

What we are not discussing is the large budget "polished" look of productions commonly associated with the Children's Television Workshop (i.e., Sesame Street), or the Agency for Instructional Television (A.I.T.). Instead, the operative concept here is "currency" rather than aesthetics, and judging from existant research, there is indeed a thriving market for the kind of informational telecommunications offered by I.T.F.S. programming. This is not meant to imply that "quality" programming options are not available to the I.T.F.S. programmer; only that they are expensive and generally not the type of content that can be copyrighted and offered by a local university for credit. Program content of this upscale a production "value" will only be cost-effective to produce if it contains a correspondingly wide appeal (i.e., approximately $60,000 per disc for videodisc productions).

The economic decisions regarding the operation and budgeting of I.T.F.S. operations should be guided by the same criteria of accountability as those in any corporate media center--cost recovery.

Initially, the UCCS budget allowed for support positions to include operations, repair and maintenance, and support services. In the area of support services, a position was budgeted for faculty liaison to conduct training of faculty, scheduling the facility, and evaluating I.T.F.S. efforts. Another position (part-time at first), was scheduled for courier services. Future projections include a qualified instructional designer/developer to assist in optimizing faculty teaching.

Currently there are no projections available on estimated revenues from the UCCS system. However, the reader should be aware that many cost-benefits are realizable from the intrinsic benefit of being perceived as the most visible information source in a given market. The benefit of this perception can generate revenues for the university in more standard ways--enrollment increases, donations, grants, etc. In many cases, and UCCS was thus affected, the institution can ill afford not to get involved.

No discussion of operation and budgeting would be complete without considering the marketing aspects of an operation, and the marketing of an I.T.F.S. facility is vitally important. An analysis of product, price, promotion and purchase needs to be performed from a systems perspective. Effective survey research should be performed to determine which course options, release formats, and specific I.T.F.S. needs must be met in your area. Projections may indicate a decided preference for live programming, or videotaped materials in any of a variety of formats (Beta, VHS, U-matic). Survey research may indicate a need for strategically scheduling certain courses at specified times. These are issues of market

demand, and failing to "target" your audience needs can mean investing monies and energies in options with little chance for success. It is the opinion of many in the low-power field that it is precisely this ability to narrow-cast that will determine low-power's possible future.

Similarly, measuring the effects of your I.T.F.S. efforts is important. This has traditionally been relegated to enrollment "head counts", number of courses offered, remote sites reached, and number of degrees granted. These are effective quantitative criteria to measure the "convenience" and efficiency of off-campus delivery systems, but are insufficient measures of the quality of instruction received. Some efforts are surfacing in the area of qualitative research (see AMCEE's evaluation of instruction instrument), but more are needed comparing telecourses with those conducted on-campus. This evaluation should be viewed as "on-going", as well as cumulative, and should be used to re-design or refine telecourse presentations. Cumulative statistics can be applied in judgments about those courses which are seemingly not well adapted to candid classroom delivery.

Final costs to users of teleresources should be budgeted on the cost of producing, duplicating, and delivering materials on-site minus standard tuition revenues. To recover additional capital and operating costs many I.T.F.S. facilities charge a teleresource fee to those receiving telecourse signals. This fee (sometimes as much as $2-3,000 per year), is oftentimes recoverable in the company's training and development budgets. The fee serves as an incentive for institutions to develop more on-site clients, as well as an encouragement for clients to make use of their

I.T.F.S. receiving system. Administrators who fail to budget for the training of operators, support/administrative services--marketing, courier, cataloging, and equipment depreciation, will cost their operation credibility and clients in the long run.

Recommendations for developing an I.T.F.S. operation in your institution begin with the establishment of a committee involving all potential users of the system. This committee should be notified prior to the first meeting, of information impacting decisions about programming, operations, evaluation, marketing, etc. This will enable a more parsimonious discussion and establishment of policy of the issues above.

The committee should set prices for live versus videotaped delivery, fees for eventual teleconferencing use, and establish long range plans in areas of budgeting, operations, and programming. The committee should be comprised of a representative number of faculty and administrators, and should seek to establish "fair" compensation for faculty participation in I.T.F.S. efforts. This committee will be instrumental in contracting with outside commercial interests wanting excess channel space. These negotiations should be guided by efforts to avoid those problems mentioned earlier in this paper.

Policies on faculty compensation should be guided by a thorough understanding of copyright legislation affecting the academician, and by allowing for off-loads and/or teaching assistance for those faculty with more than "standard" loads. As the faculty member is the owner and creator of the candid classroom "event", it is the opinion of this writer that the faculty member is entitled to some compensation from the outset

as well as for the residual sale of the tapes.

The future of I.T.F.S. is dependent on the operational realities of budgeting, programming, etc., and on the technologies that will deliver this form of instruction in the future. Among the more crucial operational concerns in the future will be that of programming. The lease payments of outside commercial interests will not be adequate to sustain I.T.F.S. operations of the future. Systems will succeed or fail based on their ability to research and respond to local programming needs. Failure to meet this challenge will likely eventuate in nationally based programming organizations, like the National University of the Airwaves (NUA), and the National Technological University (NTU), consolidating the teleresource market. This consolidation would result in a national credit-granting institution, making local efforts to offer the same largely unnecessary. Feasibility studies for this type of operation and distribution are already underway, with many AMCEE institutions currently participating. A logical consequence of this would be for the "best" instructors in their respective fields to move to the national level of distribution, as has happened in the commercial radio and television industries.

Future programming concerns for I.T.F.S. operations must also take into account the nature of the typical I.T.F.S. program format, and the use of the typical telecourse on-site. "Talking head" television is the format most commonly associated with the failure of educational television in the late 1960's and 70's (among other reasons). While this is an arguable point, most would agree that unless programmers begin

experimenting with alternative formats--those utilizing greater post-production (editing) and more visual variety, the talking head format, and thus, I.T.F.S. programming, could be in difficulty. A great deal of research supports the use of print materials and on-site tutors to augment I.T.F.S. telecourse efforts. Still more research shows the comparative effectiveness of computer-assisted (CAI) and interactive instructional television, combining the technologies of video-disc, personal computers, and advanced television production techniques.

In conclusion, whether a college or university gets involved with I.T.F.S. should be a committee decision. This decision should be based on solid researching of the local teleresource needs. If the decision is made for the institution to go ahead, the process of applying should begin immediately to avoid losing the channel allocation or potential lease agreements to other nonprofit groups. A number of experienced consultants are available to assist with the engineering application and technical requirements.

It should be decided early on if the institution wishes to enter a consortium. Based on market analysis, determine which courses will be offered, in what formats, and in what price range. Establish a means of recovering as many costs as are practical. Make the enrolling in courses as "user friendly" as possible, playing up the convenience of I.T.F.S. If it is decided to enter a lease agreement, avoid the pitfalls of long leases, laissez-faire agreements on programming content, and the lack of alternatives if the lease fall through.

Realize, and make others in your institution aware of, the limitations

and "currency" of your candid classroom format. Discuss and encourage on-site use of tutorial assistance and supplemental print materials. Consider experimental projects utilizing more sophisticated production values.

Suggest that planning for I.T.F.S. operations begin well in advance of its "on line" use. Do not wait until the system is in place to find out what (or if) I.T.F.S. needs exist in the marketplace. Likewise, do not expect 100% realibility from the system once it is in place.

Evaluate the effects of your I.T.F.S. efforts quantitatively and attempt evaluation of the televised instructional materials against more traditional delivery systems. Finally, establish fair and equitable arrangements for compensating faculty.

It should be remembered that faculty time is a precious resource, oftentimes allocated among competing uses. When all technical requirements are met for I.T.F.S. operation, they will represent only the minimal criteria for low-power telecasting. The true measure of the I.T.F.S. system will be determined by the quantity and quality of program options, support services, and degrees awarded.

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